PB-230 613

POLLUTION OF THE NAVIGABLE WATER OF PUGET SOUND, THE STRAIT OF JUAN DE FUCA AND THEIR TRIBUTARIES AND ESTUARIES, WASHINGTON. PROCEEDINGS OF CONFERENCE SESSION (2ND), HELD AT SEATTLE, WASHINGTON ON SEPTEMBER 6-7, AND OCTOBER 6, 1967. VOLUME 3

Federal Water Pollution Control Administration
Washington, D.C.

1967

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PB 230 613

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MORNING SESSION, FRIDAY, OCTOBER 6, 1967

CHAIRMAN STEIN: The Conference is open.

This is the reconvened session of the Conference in the matter of pollution of the interstate waters of Puget Sound, Strait of Juan de Fuca, the tributaries and estuaries, involving the State of Washington and the United States Government, represented by the United States Department of Interior.

The Conferees are Mr. Roy M. Harris on my right, who represents the State of Washington, Mr. R. F. Poston, on my left, who is the Regional Director for the Federal Water Pollution Control Administration, United States Department of the Interior.

My name is Murray Stein. I am from Washington, D. C., United States Department of the Interior, and the representative of Secretary Stewart Udall.

We recessed the second session of the Conference for a couple of weeks to get additional information and fully consider the matter. I think the Conferees have done that, and I also think this is a very appropriate place to hold the meeting. I am reminded of a statement of a former boss of mine, and I guess if you live long enough you amass more bosses than you know what to do with, but President Harry Truman said, "If you can't stand the heat, stay out of the kitchen." (Laughter.)

MR. STEIN

Mr. Poston, may we call upon you for the additional statements received during these two weeks.

Mr. Poston.

SUPPLEMENTAL PRESENTATIONS

BY LETTER

MR. POSTON: This is a letter received from Fibreboard Corporation. It is addressed to Mr. Harris and myself.

FIBREBOARD CORPORATION

"September 14, 1967

"Gentlemen:

"The joint water pollution study by the FWPCA and the Washington State Pollution Control Commission has developed the report of March 1967 and certain recommendations for implementation and enforcement plans for control of potentially polluted waters.

"As the recommendations relate to the Port Angeles Harbor waters and the Fibreboard Plant, the Federal agency would require:

"1. Primary treatment for settleable material and 70% reduction in all volatile suspended solids;

"2. A submarine outfall discharging fifty feet below the surface of the water; and

"3. Removal of the sludge bed and depositing same on land.

"The State recommends:

"1. Primary treatment for settleable material; (They question the feasibility of the Federal's 70% reduction in volatile suspended material).

"2. A submarine outfall with diffuser outlets;

"and 3. Sludge bed removal and depositing same on land.

"In addition, our Port Angeles Plant has the requirement of connecting sanitary sewage facilities to the City of Port Angeles system treatment plant when it is available. We have already made a verbal commitment to the City of Port Angeles to do this.

"This plant was constructed in 1918 as a sulphite and ground wood mill. Although it operates at some competitive disadvantage with the newer, more versatile sulfate plants and even though it is somewhat removed geographically from our converting facilities, we have a continuing program of needed and reasonable improvement to permit its continued competitive operation. We expect to continue this program which includes reasonable requirements for pollution control. If, however, we are obliged to spend large sums for changes which serve no real purpose, our entire program will be in serious jeopardy.

"Particularly, we are concerned about the

FIBREBOARD CORPORATION

proposed requirement for the removal of sludge beds because of the great expense involved and the lack of any helpful results. This is evident from our statement, together with the statement of September 1, 1967 of the renown Sanitary Engineering Consulting Firm, Brown & Caldwell. These statements are attached as Exhibits C and D, respectively.

"Also, we feel that there is no evidence of direct damage to fish life in these Port Angeles Harbor waters. At the hearings conducted by the Washington State Pollution Control Commission in Port Angeles on December 15, 1966, testimony was heard that there were no oyster beds in the area: It was also pointed out that these waters are too cold for swimming and that there were no beaches in the area. Mr. Edward Cavanaugh, Manager of our Port Angeles Plant, said, 'we would like to record our belief that these proposed standards have failed to take into consideration the use and value of the waters under consideration for industrial and other legitimate uses. We also believe that these proposed standards have failed to take into consideration the assimilating capacity of the waters in question......'. A copy of his full statement is attached, as Exhibit A.

"At the hearing held on June 6, 1967, at Olympia, Washington, by the Washington State Pollution Control Commission, we protested the high classification of the Port

Angeles Harbor waters, as no evidence has been submitted that fish life in this area is being harmed. The waters should be classified as primarily industrial. A copy of the full statement made by Mr. E. Cavanaugh is attached as Exhibit B.

"On September 6-7, 1967 at a joint conference of the Federal Water Pollution Control Administration and Washington State Pollution Control Commission, we again noted there was no direct evidence that fish life was being harmed by our effluent waters.

"In considering anti-pollution measures, you should consider need, reasonability and the economic background. The assimilating capacity of a receiving body of water is an important aspect bearing on these factors.

"In review, we can summarize our viewpoints as follows:

"1. There is no sufficient evidence to show that fishlife is being harmed in the Port Angeles Harbor waters;

"2. There is no justification for the removal of sludge beds;

"3. There is no justification for discharging the effluent fifty feet below the surface of the water;

FIBREBOARD CORPORATION

"4. The Port Angeles Harbor waters should be classified as industrial waters; and

"5. Considering the age of our plant, its location and competitive conditions, it is questionable as to whether there would be justification for the expenditure of large sums of money, without return on investment.

"We respectfully ask you to give careful consideration to the points which we have enumerated.

"Very truly yours, FIBREBOARD CORPORATION, William Geisler, Vice President."

MR. POSTON: There are attachments to this, the exhibits mentioned, and I will submit those for the record, Mr. Chairman.

CHAIRMAN STEIN: Without objection, they will be entered.

(Which said attachments to the Fibreboard Corporation letter are as follows:)

EXHIBIT A

STATEMENT FOR WATER QUALITY STANDARD HEARING

ELKS CLUB

PORT ANGELES, WASHINGTON

December 15, 1966

FIBREBOARD STATEMENT

My name is Edward J. Cavanaugh. I am Plant

FIBREBOARD CORPORATION - EXHIBIT A

Manager of the Port Angeles Division of Fibreboard Corporation.

Fibreboard Corporation would like to express to the Washington State Pollution Control Commission its concurrence in the suggested criteria for the Water Quality Standards and the supporting statements with reference to these suggested criteria made by Donald R. Graunke and Storrs Waterman, representing the Natural Resources Committee of the Association of Washington Industries, and which we believe have the support of industry generally.

We also wish to express to the Commission our concurrence in the objective of the Commission in the promulgation of proper water quality standards for the waters of the state and of this region in particular, and we assure the Commission of our cooperation in the achievement of this objective and want to record our appreciation for the objective approach to this most difficult task.

With reference to the proposed water quality standards set forth in the information bulletin which is the subject of this hearing, we would like to record our belief that these proposed standards have failed to take into consideration the use and value of the waters under consideration for industrial and other legitimate uses. We also believe that these proposed standards have failed to take into consideration the assimilating capacity of

FIBREBOARD CORPORATION - EXHIBIT A

the waters in question for industrial waste which has received practicable treatment or has been placed under control. We also feel that they have failed to recognize the use of these waters as a proper and beneficial use for the people of this area. It is also our belief that the proposed standards have failed to take into account and to give due consideration to the practicability and to the physical and economic feasibility of complying with such standards.

Based on our Attorney's opinion we would also voice our belief that pages 19 - 24 of the information bulletin do not constitute a plan within the meaning of the Federal Water Quality Act of 1965 for the implementation and enforcement of such water quality standards as may be adopted by the Commission pursuant to these hearings. We would submit that any determination made pursuant to these hearings, that any person or firm was not in compliance with such standards as may be ultimately adopted by the Commission or that any specific treatment or control should be established would be unlawful and would deprive such person of their constitutional rights. We therefore request that Table II and the subject matter of pages 19 - 24 of the information bulletin be deleted from any order of the Commission which is intended to have the force of law or

FIBREBOARD CORPORATION - EXHIBIT A

any legal effect.

We appreciate this opportunity to comment on the proposed standards and, in view of the holidays, request that the records be held open until January 16, 1967 for any supplementary statement we wish to file.

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FIBREBOARD CORPORATION - EXHIBIT B

My name is Ed Cavanaugh, associated with Fibreboard Corporation, a firm which has an industrial plant in Port Angeles.

In reviewing the classification which you are considering today for the Port Angeles harbor waters, it is our belief that based on testimony submitted at the hearing held in Port Angeles on December 15, 1966, relative to these waters and considering that this area has long been classified in the industrial category, the classification which you have proposed is much higher than necessary for proper protection of these waters.

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FIBREBOARD CORPORATION - EXHIBIT C

My name is Edward J. Cavanaugh, Plant Manager of Fibreboard Corporation, Port Angeles Plant.

Based on a study made by Brown and Caldwell, a consulting firm of sanitary engineers, in 1961 of offshore

FIBREBOARD CORPORATION - EXHIBIT C

water conditions at our Port Angeles Plant, I can find no justification to the requirements for the removal of sludge bed and the installation of a discharge line 50 feet below the surface of the water.

To substantiate the above statement, we submit a copy of Brown and Caldwell's letter of September 1 dealing with the subject.

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FIBREBOARD CORPORATION - EXHIBIT D

BROWN AND CALDWELL
CONSULTING ENGINEERS
San Francisco-San Marino-Seattle
66 Mint Street-San Francisco, Calif.
YU 2-2442

Waterworks - Drainage
Wastewater Treatment
Rate Studies - Valuations
Chemical & Bacteriological
Laboratories

C.M.S
K. W. Brown - 1944-1961
D. H. Caldwell - CE 6287
F. J. Kersnar - CE 8799
J. C. Luthin - CE 5697
J. T. Norgaard - CE 6821
R. F. Wilcox - CE 8274
F145B

September 1, 1967

Mr. Claude Stitt, Fibreboard Corporation,
1789 Montgomery Street, San Francisco, California 94106

WATER WASTE DISPOSAL, PORT ANGELES MILL

Dear Mr. Stitt:

As you requested, we have reviewed reports and other data collected in the course of our oceanographic investigations of conditions in Port Angeles Harbor and are submitting herewith a summary of those observations.

During December 1961 our firm conducted an underwater investigation in the harbor offshore from the Port Angeles mill to determine the extent of deposition and the apparent effects on marine life in the vicinity. Personnel involved in the work were sanitary engineers, one of whom was a scuba diver, a biological oceanographer, and professional scuba divers. The underwater work was carried out for a total of seven days and also included inspection of areas in both Port Angeles Harbor and at Neah Bay, 75 miles westward, where conditions were unaffected by pulp mill discharges. Underwater photographs were taken and detailed field notes were kept.

Effects of Solids Deposition

The deposition area attributable to wastewater discharge from the Fibreboard mill covers an area of about 115 acres and, in general, was found to occupy a segment of a circle with a radius of about 2500 feet lying northerly and easterly of the mill. This area amounts to about 3.4 percent of the area of the bottom of the Port Angeles Harbor as a whole.

Bottom deposits in general did not exceed 24 inches in depth. At the outer edges, the deposition feathers out to a band or strip of isolated clumps of fibrous material. This strip ranges in width from a few feet to several hundred feet. Inspection indicated that a condition of general equilibrium existed between the depth and extent of the deposited material and the bottom currents.

Observations by divers in the deposition area revealed an abundance of marine animals living on and immediately above the deposits. Those noted include: spider crab, anemone, limpet, starfish, shrimp, sculpin, and flounder. Existence of these creatures is indicative of aerobic conditions on the surface of the deposit.

Except for a shallow surface layer, the water overlying the deposition area was found to be quite clear and schools of several different species of fish and other animals were observed. These included Pacific herring, yellowtail rockfish, Pacific staghorn sculpin, starry flounder, shrimp, krill, spider crab, hermit crab, starfish, anemone, nudibranches, and octopus. Local divers, in addition, reported the presence of lingcod, marbled sculpin, and black rockfish. On several occasions, sports fishermen were observed catching salmon adjacent to the Fibreboard dock which is located in the deposition area.

Observations of the marine biota on and in

FIBREBOARD CORPORATION - EXHIBIT D

the immediate vicinity of dock pilings revealed a profusion of biological activity. Inhabitants included acorn barnacles, sponges, anemones, nudibranches, sea urchins, chiton, jingles, keyhole limpets, tubeworms, starfish, and spider crabs.

Comparison dives were made at Neah Bay and the Thunderbird Boathouse, just inside Ediz Hook at Port Angeles. At Neah Bay, pilings exhibited a more abundant growth of tubeworms and mussels, but not as heavy a growth of anemones and sponges as found on the Fibreboard dock pilings. Growth on pilings at Thunderbird Boathouse was found to be quite similar to that at the Fibreboard dock. Little or no differences in the variety of fish were noted between the three areas.

These studies demonstrate quite dramatically that a well balanced marine community exists on and over the area of deposition offshore from the Fibreboard mill. As a result, we have concluded that the marine environment has not been adversely affected by deposition from the waste discharge. Under these conditions, mechanical removal would not improve the bottom environment and could cause adverse conditions during the extended period which would be required for such an operation.

FIBREBOARD CORPORATION - EXHIBIT D

Effects of Proposed Submarine Discharge

Because its density is much less than that of seawater, wastewater discharges at or near the surface form a relatively thin layer. During the 1961 study, it was found that clear underlying seawater was brought to the surface by a small boat's propeller. Such a surface is exposed to wind and wave action and, therefore, tends to disperse quite rapidly. The immediate oxygen demand of the waste is met by surface reaeration and by dilution in the surface waters. Accordingly, it has a negligible effect on dissolved oxygen levels in the great mass of underlying seawater. This conclusion is attested to by the observation of marine life reported in the preceeding paragraphs.

The question arises as to the relative merits of a deep water discharge into the harbor. By discharging through a multiple-port diffuser, it is possible to obtain rapid initial mixing, possibly as high as 60 parts of seawater to 1 part of wastewater. The mixture, however, will form a relatively thick surface field which will have a lesser tendency to remain on the surface. Thus a higher concentration of sulfite waste liquor would exist in the underlying waters. As a result, a greater depression of dissolved oxygen levels would be expected that with a surface discharge.

FIBREBOARD CORPORATION - EXHIBIT D

Normally, it is considered desirable in municipal waste disposal practice to provide for as deep a discharge and as great a degree of mixing with underlying waters as possible. In the present case, however, it appears that so doing could well cause adverse effects on the marine environment which do not exist with a surface discharge. For these reasons we cannot concur in an arbitrary requirement with respect to the depth of the discharge. We recommend that such a decision be based on results of a study of the dispersion characteristics and tidal currents, both surface and deep, in the vicinity of the discharge.

We trust this summary will meet your needs at the forthcoming hearing. Please call if any questions arise.

BROWN AND CALDWELL
(Signed) D. A. Reinsch
D. A. Reinsch
cc

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MR. POSTON: Next we have a letter from the Weyerhaeuser Company, which reads as follows:

WEYERHAEUSER COMPANY

"September 19, 1967

"Weyerhaeuser Company would like to take advantage of the extension of time granted in holding open the record of the reconvened State-Federal Conference on the subject of Pollution of the Navigable Waters of Puget Sound and the Straits of Juan de Fuca and Their Tributaries and Estuaries.

"We would like to enter into the record the attached statement by Robert Knight, given in behalf of the Everett Mills Technical Committee as presented before the Washington State Pollution Control Commission Hearing on Water Quality Standards, held in Mount Vernon, Washington, February 9, 1967. The rather bulky report documenting Mr. Knight's statements is already in the possession of the Washington State Water Pollution Control Commission as part of the proceedings of the aforementioned hearing.

"The FWPCA and the WSWPCC conducted fixed and mobile live-box salmon fingerling bioassays in April and May of 1963. Since that time several changes have been made which renders their data obsolete. This point of obsolescence was brought out in the statement of the Everett Technical Committee at the reconvened conference, September 6 and 7. The following are changes which affect waterfront quality at Weyerhaeuser Company's Everett Sulphite Mill.

"1. A clarifier has been installed to treat woodroom wastes. This clarified effluent discharges via the main sewer.

"2. An acid filter backwash salvage system has been installed.

"3. A knot pit was built. Knotter rejects, formerly sewered during times of failure of waste system, are now diverted to a holding bin.

"4. Bleach plant fiber from washer vat drains and major floor drains are now routed to screen room stock system.

"5. Chip and hogfuel barge unloading facilities have not been changed but the amount unloaded has been drastically reduced. Hogfuel is now trucked across town and dumped at powerhouse. Only about four barges each of chips and fuel are unloaded per month now. This has reduced spillage to the Bay.

"6. Sulfur is now received molten by rail. Thus no more elemental sulfur is lost at the dock front while unloading ships.

"7. The main sewer underwater outfall has a hard sand spit built up in front of it. This buildup alone shows the change in the composition of the settleable solids carried.

"Very truly yours, J. O. Julson, Director, Air and Water Resources."

MR. POSTON: Mr. Chairman, I submit this

for the record.

CHAIRMAN STEIN: This has an attachment, too. Without objection, they will be entered into the record.

(Which said attachment to the Weyerhaeuser Company letter is as follows:)

February 6, 1967.

Everett Mills Technical Committee, Everett, Washington.

Gentlemen:

My name is Robert Knight. I reside in Everett and am the Technical Director of the Sulphite Mill of Weyerhaeuser Company. I am here today as Chairman of the Everett Mills Technical Committee composed of various members of the technical staffs of the pulp and paper companies located in Everett, that is, Weyerhaeuser Company, Scott Paper Company and Simpson Lee Paper Company. This committee has, since 1953, conducted routine water monitoring in Port Gardner Bay and the Snohomish River. It is the Committee's responsibility to supervise routine water monitoring surveys and to administer research programs in Port Gardner Bay that are jointly sponsored by our companies.

At this time I would like to submit the report of the Everett Technical Committee for the record. This

WEYERHAEUSER COMPANY ATTACHMENT

report is lengthy and documents in detail the following items:

1. The Water Survey Program of the Everett mills with emphasis on the existing quality of the waters,

2. The water uses within the area,

3. The standards proposed for these waters,

and 4. Treatment needs.

As a part of the Technical Committee report there are attached a number of statements or reports as follows:

1. A statement of conclusions and three technical reports covering the bottom fishes of Port Gardner Bay by Dr. T. S. English of the University of Washington Department of Oceanography.

2. A statement by the University of Washington Fisheries Research Institute covering their conclusions on studies regarding fingerling salmon migration in Port Gardner and the Snohomish River.

3. A statement by Vincent Barcott, operator and owner of the trawler 'Point Defiance', regarding bottom fishing in the waters between Everett and Whidbey Island.

4. A statement by Frank Barcott, Jr., owner and operator of the trawler 'Lemes', regarding bottom trawling.

WEYERHAEUSER COMPANY ATTACHMENT

5. A statement by A. C. Zuanich, owner and operator of the trawler 'Voyager', regarding the hake fishery in Port Susan and Saratoga Passage.

6. A statement by Frank A. Zuanich, owner and operator of the trawler 'Wisconsin', regarding the hake fishery in Port Susan and Saratoga Passage.

7. A statement by Kenneth G. Tapert of Puget Sound By-Products regarding Hake production.

8. A report by W. P. Breese of the Department of Fisheries and Wildlife at Oregon State University entitled 'Factors Influencing the Development of Pacific Oyster Larvae in 48 Hour Bioassays.

9. A statement by Leiter Hockett, deep sea diver, regarding observations while inspecting the deep water diffuser line.

10. A report by Dr. Max Katz entitled 'Trends in the Steelhead Sports Fishery in the State of Washington with Emphasis on the Fishery in Streams of the Puget Sound, Hood Canal and Grays Harbor Areas' will be submitted for the record within two weeks.

11. A report by R. Tollefson entitled 'Biological Survey - Port Gardner Bay and Snohomish River' will also be submitted for the record within two weeks.

"Rather than read this document in its entirety, we summarize as follows:

A review and discussion of significant chemical and biological data has been prepared for the waters of the Everett area for consideration by the Washington State Pollution Control Commission in establishing water quality standards.

The 'Criteria for Water Quality Standards', as presented by the Association of Washington Industries, has been considered and found to provide a general rationale and a set of practical working standards which, if adopted, will ensure proper protection for all water uses, including waste assimilation.

The deep water diffuser jointly operated by two sulphite pulp mills provides an example of a working waste dispersal zone compatible with the concept of multiple use of the waters.

The variability shown in the compilation of water quality data cited exemplifies the complexity of the estuarial system and points to certain impractical aspects of the standards being proposed. The narrow limits proposed do not indicate sufficient consideration of seasonal, diurnal, hydrographic, and meteorological factors.

The oyster larvae bioassay as generalized evidence of pollution is subject to question. Only data derived

WEYERHAEUSER COMPANY ATTACHMENT

using organisms indigenous to an area are applicable for this purpose. Recent unpublished studies and an evaluation of the techniques of the test raise questions relative to test conditions and application of results.

Research studies covering both the anadromous and demersal fisheries have been conducted. Results of these studies in conjunction with commercial and sports catches indicate thriving fisheries exist. Thus, an adequate food supply of necessity must be present and no deleterious effect from waste disposal is exhibited.

Mr. Harris, we appreciate the opportunity to submit this report today, and we wish to emphasize our willingness to work with the staff of the Commission at any time in the establishment of equitable water standards.

Thank you.

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MR. POSTON: We have a letter from the Halibut Fishermen's Wives' Association, Seattle, Washington. The letter reads as follows:

HALIBUT FISHERMEN'S WIVES' ASSOCIATION

"September 20, 1967

"The Halibut Fishermen's Wives' Association concurs with the report given by the Federal and State Agencies, published in March of 1967, on pollution control of Puget Sound waters. It is vital to the economy of the

State for both industrial and recreational usage to protect these waters.

"Very sincerely yours, Barbara E. Sivertsen, Corresponding Secretary."

CHAIRMAN STEIN: Thank you.

MR. POSTON: We have a letter from the Association of Western Pulp and Paper Workers.

ASSOCIATION OF WESTERN PULP AND PAPER WORKERS

"September 19, 1967

"My name is John R. Swanson, Northern Area Representative of the Association of Western Pulp and Paper Workers. The mills involved in the pollutional effects of pulp and paper mill wastes in Puget Sound are mills whose hourly employees I represent for our Union.

"I had the opportunity of being present at the recent hearings in Seattle and also since that time have had an opportunity to study the report dated March 1967. As an interested party, a union representative and a citizen, I was certainly very interested in the hearings and also the report filed by the Commission. I would very much like to point out my concerns in this matter for the record.

"First, I am very interested and concerned about pollution controls in our streams and estuaries and in the waters of Puget Sound. As a citizen, I have always been an avid sportsman, skin-diver and fisherman - particularly in the area around Port Angeles.

"As a Union Representative, I am very concerned about the impact of the Government's study on the pulp and paper industry in the Puget Sound area and certainly I must admit that our actions - mine as well as other interests - are motivated to a degree by selfishness.

"In my every day dealings with the pulp and paper industry and my knowledge of the activities of other industries in the Puget Sound area, I must point out clearly - and it certainly is known to the Commission - that the pulp and paper industry has, through the past several years, spent considerable amounts of money on pollution control. They have also, diligently, through their research departments and technical help from other agencies, endeavored to find ways of cleaning up their waste disposal facility. The Government must agree that the contribution of the pulp and paper industry toward pollution control in the past few years has been a considerable contribution and certainly this is not true of many of the other industries in the area.

"It is easy to see in observing a pulp mill operation, their outfalls, the change in the color of the water by the discharge of sulphite waste liquors, and so it becomes a very obvious thing to point to by any and all

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observers. It is also a fact that the affluents discharged by other industries are not so visibly seen and not so clearly recognizable to the untrained observer. Even though emissions by other industries and those emissions necessary for pest control and city sanitation are much more injurious and much more toxic to the various forms of sea life and fishes than pulp mill emissions.

"I realize, of course, that the pulp mills have to continue in their efforts to clean up our streams and estuaries and Puget Sound. It must be pointed out however, that the Puritanical outcries of the shellfish and oyster growers are selfishly motivated far beyond any concern for public interests and public welfare. It certainly is well-known and clearly understood in the Puget Sound area, particularly in the area of Hood's Canal, that if the oyster growers and shellfish people had their way, my family and I would never be able to walk down a public beach and pick oysters and dig clams, etc. This land would be completely controlled and regulated by the oyster growers if they were able to perpetuate the aims that they seek. Shellfish were placed on this earth by divine providence and the will of the Lord. It took very little work, very little economic investment by the people in the shellfish industry. Certainly they have found ways to increase the yield, etc., by scientific

ASSOCIATION OF WESTERN PULP AND PAPER WORKERS

study. However, their initial investment in this industry was made by someone other than themselves, and certainly any large expenditure by the pulp and paper industry in the area of further pollution control either necessary or unnecessary, will yield a much greater boon to the oyster grower, if what they say is true, than it ever could yield to the public interest.

"It would seem to me as a layman and an observer, that if they are so interested in the public welfare and have so much more to gain than anyone else in pollution control, that they should then be willing to share substantially in the costs of any further pollution control, and certainly it would seem that they could themselves then pay at least half of any additional expenses necessary by the pulp mills, unless their outcries are completely selfishly motivated.

"I must point out to the conferees that I am very concerned about the pulp and paper industry being treated in an unfair manner because this has become an issue between the shellfish growers and the pulp and paper industry, rather than an issue in the interests of public safety, public health and public welfare.

"I sincerely hope that all of our interests are devoted to the public welfare without regard for private interest groups and that our primary concern is for what is right. The point that I am trying to make is that our employees, working in the pulp and paper mills are private citizens first, and employees of the pulp and paper industry second, and certainly many, many of them have an interest in clean, pure water for fishing and recreational activities. They are also concerned that the industry for which they work is treated fairly and justly and not penalized by unfounded outcries of any selfish-interest group.

"The report by the Government and the intensive research done by the Government seem to indicate there were a great many areas for honest differences of opinion and further seem to indicate that the Government and the Commission needed to do a great deal more work before any concrete facts and recommendations could be established and put into effect.

"I wish to reiterate that any unfair and unnecessary expenditures forced on the pulp mills makes it difficult for our people to secure the proper type of wages and conditions that they are entitled to through collective bargaining processes. If, in fact, a more stringent code must be adopted, and more strict procedures must be enforced, then this should only be done after the most complete study based on the absolute facts of the situation and not be distated by outside pressures which would very much like to impose what might very well be unnecessary restrictions on the pulp and paper industry.

"In conclusion, gentlemen, I wish to state that as a private citizen and a member of the community and also as a labor representative, we want to work with you in the Government and with your Commission in an effort to protect the general welfare of the people in the State of Washington and everywhere in the United States. We must and will insist that our desires be motivated by what is just and right, based on the best possible information, rather than based on the outcries of self-interest groups who contend their primary interest is the public welfare, while, through the many years of their history, they have indicated that their primary concern was for their own self-interest.

"Once again, I ask you to give consideration to the large expenditures that have been spent by the pulp mills and certainly the testimony indicates that the pulp and paper industry is willing to spend a great deal more money and a great deal more time and a great deal more study in an effort to cooperate and do what is necessary to guarantee that they will not destroy our natural resources or deny our natural resources to other water users.

"I am certain that the conferees will study this matter carefully and I am certain that their dedication will allow no verdict that is not fair and just to all parties concerned. I have appreciated the opportunity of being able to listen to the testimony of both parties. I was somewhat chagrined that the Government findings were not more complete, but I am certainly pleased that the Government is working and will continue to work in the public interest.

"It may seem that I have taken a position in support of the pulp mills. This is not necessarily the case. I feel that the primary consideration should be fair and equitable treatment. Federal pressure has been brought to bear regardless of the unfortunate necessity for this pressure, however, it must be admitted that the pulp mills have yielded to this pressure and are endeavoring to do something in the public interest. The union members' position as public spirited citizens and employees in industry must be considered by the conferees and their position on the horns of this dilema requires careful consideration and scrutiny by all parties.

"Thank you very much for the opportunity to submit this statement on behalf of the private citizens in my area, on behalf of the employees in the pulp and paper industry in my area. On behalf of our Union, the Association

ASSOCIATION OF WESTERN PULP AND PAPER WORKERS

of Western Pulp and Paper Workers,

"Respectfully submitted, John R. Swanson, Area Representative."

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CHAIRMAN STEIN: Thank you.

MR. POSTON: I have a brief letter here from Thor Tollefson, Director of the Washington Department of Fisheries.

STATE OF WASHINGTON DEPARTMENT OF FISHERIES

"September 21, 1967

"Enclosed herewith is our supplemental statement concerning the second session of the conference in the matter of pollution of the navigable waters of Puget Sound, Strait of Juan de Fuca and their tributaries and estuaries - September 6-7, 1967, Seattle, Washington."

MR. POSTON: Included are a number of appendices which I submit for the record.

CHAIRMAN STEIN: Without objection, the appendices will be included as exhibits and the letter will appear in the record.

(Which said appendices are as follows:)

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT A

September 20, 1967

SUPPLEMENT TO THE WASHINGTON STATE DEPARTMENT OF FISHERIES STATEMENT PRESENTED TO THE CONFEREES AT THE

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT A SECOND SESSION OF THE CONFERENCE IN THE MATTER OF POLLUTION OF THE NAVIGABLE WATERS OF PUGET SOUND, STRAIT OF JUAN DE FUCA AND THEIR TRIBUTARIES AND ESTUARIES - SEPTEMBER 6-7, 1967, SEATTLE, WASHINGTON

Mr. Chairman and Conferees:

The Washington Department of Fisheries reaffirms its position concerning the findings and recommendations of the joint Federal-State report, "Pollutional Effects of Pulp and Paper Mill Wastes in Puget Sound", March 1967, presented in Seattle, Washington in September 1967.

The use of the marine and estuarial waters by fish and shellfish is acknowledged here and in the Department of Fisheries statements on proposed water quality standards presented at the Washington State Pollution Control Commission hearings on December 15, 1966 at Port Angeles and on February 9, 1967 at Mount Vernon, Washington and are submitted as part of this supplement. Further, to illustrate the complexity of salmon management, there is attached hereto a copy of our recommendations as proposed for the management of the 1967 Puget Sound commercial salmon fisheries.

The proposed recommendations contain repeated references to hatchery production of chinook and coho salmon. Maintenance of these stocks within an exploitable level has

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been achieved through increased production at our hatcheries and at an increase in cost to the taxpayers. Hatchery production of pink and chum salmon has not yet proven feasible and maintenance of these stocks is even more critical.

The fact that these salmon runs have already been subjected to various fisheries prior to entering Puget Sound further demonstrates the need for a thorough knowledge of any given fishery. Therefore, we consider that the use of statistics on salmon and steelhead landings from selected area as presented by Dr. Max Katz to the conferees to demonstrate that certain salmonid populations were doing as well in areas of pollution, as in unpolluted waters, to be invalid. Similarly, the statement of Dr. Thomas English to the conferees concerning English sole is considered as unnecessary objection. The joint Federal-State report clearly acknowledge no demonstrable adverse effect of pulp pollution on the bottomfish present in deep water in the Everett area. Further, statements attributed to commercial trawl fishermen may be discounted on the basis that the English sole and hake were caught in deep water outside of Everett harbor.

We would stress that most of the speakers for the pulp and paper industry attempted to create the impression that the Federal Water Pollution Control Administration recommendations were tied to economic damage to the fishery resources. Whereas, the key issue being considered was whether the waters under discussion are or are not polluted, to what degree, and the measures that must be taken to alleviate the polluted conditions.

Determination of water pollution through measurements of primary productivity and the use of the Pacific oyster embryo bioassay technique was critically commented upon by the pulp and paper industry.

Referring first to the primary productivity studies, we feel that this matter was resolved by the speakers and the conference chairman. However, for the record we have attached a report (Westley, 1967) indicating the interactive effect of sulfite waste liquor on photosynthesis in estuarial waters.

With regard to the oyster larvae bioassay, we feel that most of the questions are adequately answered in Appendix I of the original statement presented by the Washington Department of Fisheries to the conferees and in the report, "Measurement of Water Quality by the Pacific Oyster Embryo Bioassay" submitted for the record as part of this supplement.

However, we will take this opportunity to offer our comments on some statements made by Messrs. Donald Benson, Gene Haydu, and Roger Tollefson. We must point out that the work of Professor Breese referred to by Mr. Benson was carried out with "stripped" rather than spawned oyster eggs. The use of "stripped" eggs for any sort of molluscan larvae work has been generally discredited by Dr. Loosanoff and his co-workers as well as most other researchers studying and growing bivalve larvae. Further, we feel that the oyster larvae bioassays reported by the FWPCA were conducted at a temperature considered to be quite ideal by marine biologists working with oyster larvae.

Considering Mr. Haydu's statements on the oyster larval bioassay tests, we agree that differences exist between response levels of various forms (Mr. Haydu considers shrimp, fish and oysters) to some toxicants, and concur that safe levels for one species may be lethal to another. We also agree in principle with his comments regarding the use of "reference animals" to determine relative toxicities. We would extend this particular point to include the fact that if any reference animal is antagonized in any way by the material being tested, such material not be discharged to a water course until it is proven nontoxic. We feel that an "appropriate margin of safety" should be applied by the FWPCA with respect to oyster larvae.

Also even though species of shellfish native to the area (Everett) have not been used as bioassay animals, STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT A

we feel that the work by researchers referred to in "Measurement of Water Quality by the Pacific Oyster Embryo Bioassay" indicated general agreement of response levels of oyster larvae and forms similar to those native to the area in bioassays of a number of toxicants.

While the statement of Mr. Roger Tollefson concerning the absence of oyster larvae in Port Angeles waters may be quite true, it must be remembered that adverse oyster larvae responses attributable to SWL at present occur in water within a few hundred yards (straightline measure) of commercial oyster beds. In view of the close proximity of the Port Angeles pulping wastes to oyster beds, we must reiterate our concern over their continued unregulated discharge into this area.

In conclusion the quality of our water courses must not be based solely on today's economics of the pulp and paper industry versus the fishery resources in the immediate area. This Department is deeply concerned that all efforts and monies spent on water pollution abatement will result in the most effective improvement of the quality of these waters. We feel that reduction of the pollution load in the entire system can be achieved only by reduction at the source. Action to achieve this should be a No. 1 priority.

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT B

APPENDIX I

BRIEF LIST OF REFERENCES RELATED TO THE TOXICITY OF WASTES TO AQUATIC LIFE

1963. Condition factors for appraisal in setting water quality standards with respect to protection of marine life. Wash. Dept. Fish., Shellfish Res. Lab. Mimeo June, 1963. 15 p.

Gunter, Gordon G. and Jack McKee. 1960. On oysters and sulfite waste liquor. Washington Pollution Control Commission. 93 p.

Hopkins, A. E., P. S. Galtsoff and H. C. McMillin. 1931. Effects of pulp mill pollution on oysters. Bull. U.S. Bur. Fish. 47:125-186.

Lasater, J. E. 1956. A biological assay of pollution in Port Gardner in 1954 and 1955 and the Duwamish Waterway in 1955. Wash. Dept. of Fish. Ms. 64 p.

LeMier, E. H. 1962. Bellingham Bay water quality study, May - June, 1962. Wash. Dept. Fish. 9 p. and (72nd annual rept. 19-21 p.)

McKernan, D. L., V. Tarter and R. Tollefson. 1949. An investigation of the decline of the native oyster industry of the State of Washington, with special reference to the effects of sulfite pulp mill waste on the Olympia oyster (ostrea lurida). Wash. State Dept. Fish. Biol. Bull.

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT B No. 49-A, p. 117-165.

Pollution Control Commission, State of Washington. 1957a. A reinvestigation of pollution in Grays Harbor. Tech. Bull. No. 21, 51 p.

1957b. Pollution investigation in northern Puget Sound. Tech. Bull. No. 22, 27 p.

1962. Transcript of conference in the matter of pollution of interstate waters, Puget Sound, Strait of Juan de Fuca and their tributaries and estuaries - State of Washington. First session, January 16-17, 1962. Olympia, Washington. Volume I-III. Bill's Recording Serv., Portland, Oregon.

Westley, Ronald E. 1956. Retention of Pacific oyster larvae in an inlet with stratified waters. Wash Dept. of Fish. Res. Pap. 1(4): 1-7.

Westley, Ronald E. 1959. Olympia oyster reproduction in south Puget Sound 1942-1958. Olympia Oyster Problems, Bull. (5) 1-12. Dept of Fish., State of Wash.

Westley, Ronald E. 1960. A summary of recent research by the Washington Department of Fisheries on the distribution and determination of sulfite waste liquor (S.W.L.) Wash. Dept. of Fish. Research Bull. No. 6, 7-43.

Westley, Ronald E. 1961. Evaluation of the effect of estuarine water quality on fish and shellfish.

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Wash. Dept. Fish., Shellfish Res. Lab., Mimeo. 5 p.

Westley, Ronald E. 1964. Some relationships between Pacific oyster (crassostrea gigas) condition and the environment. Reprinted from 1964 proceedings National Shellfisheries Association Vol. 55. Wash. Dept. Fish., Shellfish Res. Lab., 33 p.

Westley, Ronald E. 1967. Phytoplankton photosynthesis and its relationship to oxygen in Grays Harbor, Washington. Wash. State Dept. Fish. 30 p.

Williams, R. W., E. M. Mains, W. E. Eldridge, and J. E. Lasater. 1953. Toxic effects of sulfite waste liquor on young salmon. Wash. Dept. Fish. Res. Bull. No. 1.

Woelke, Charles E. 1958. The effects of spent sulfite waste liquor on the development of eggs and larvae to two marine molluscs and three of their food organisms. Wash. Dept. Fish., Shellfish Res. Lab., Mimeo 5 p.

Woelke, Charles E. 1967. Measurement of water quality with the Pacific oyster embryo bioassay, water quality criteria, ASTM STP 416, Am. Soc. Testing Mats., 1967, p. 112.

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT C

STATEMENT OF CHARLES WOELKE TO WASHINGTON

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT C
STATE POLLUTION CONTROL COMMISSION HEARING ON WATER QUALITY STANDARDS SEATTLE, WASHINGTON - FEBRUARY 28, 1967.

Mr. Chairman, ladies and gentlemen; my name is Charles Woelke, I am a graduate student at the University of Washington, on educational leave from the State of Washington Department of Fisheries.

May I express my appreciation for the opportunity to present my views on the topic under consideration today. Many of my remarks will embrace marine water areas other than the one under consideration therefore I request that this statement be made a part of the record of all previous hearings dealing with marine waters. I have appended to this statement a list of reports which I feel support the stand I am taking.

I am speaking as a taxpayer and waterfront property owner. I enjoy fishing, clam digging, swimming, boating, sunbathing or even just staring at or listening to the sounds of the water while relaxing. In purchasing waterfront property I paid a premium price to assure myself and my family of these pleasures of life. My views on the subject of water quality are those, or at least I believe should be those, of all owners of the approximately 2650 miles of marine waterfront in Washington State - about 800 miles of which are included in the area being considered today (1).

Though a taxpayer not an economist, converting 2650 miles to feet and multiply this by $100 (which is neither the highest or lowest price for which marine waterfront now sells) gives the rather substantial figure of about 1.4 billion dollars as the present value of Washington's waterfront property. This estimated value is exclusive of commercial oyster or clam lands, development tracts offering "beach rights" or waterfront improvements such as dwellings, docks and bulkheads.

Since waterfront is in limited supply I think it is fair to assume that the value of this type of property will increase over time. The increasing value of waterfront has not gone unnoticed by our tax collectors. In at least one county of the area being considered today (Mason),waterfront property is receiving special tax consideration under the assumption that if you can buy waterfront you can pay higher taxes. Other counties and even the state, in casting about for additional revenue, are looking on waterfront property as a possible source of additional revenue. My tax this year was $79.43 for 100' of unimproved property (2). I would like to stress that this $80 tax is on logged off, unimproved property on a dirt road without water, electricity or tidelands. A little simple arithmetic indicates that if my rate is average, the property taxes from marine waterfront in this state will produce about 111,000,000 tax dollars this year. I suggest that based on these figures waterfront owners probably provide the largest single block of real tax in the state of Washington - perhaps larger than that paid by any single industry.

As a taxpayer I am sure that an economist in evaluating waterfront property as an area resource would also take into account the business generated in the form of boat sales, water sports equipment, outboard motors, fishing gear, and other water associated purchases and upkeep. Therefore I submit that owners of waterfront property have a substantial economic investment at stake and as such are vitally concerned with any factor such as pollution which might economically or aesthetically decrease the value of their property. It is my personal conviction that water pollution poses such a threat. I feel that any water quality standards set must protect my investment today and in the future. This is especially true in view of the laws under which these standards will be implemented and administered.

It is my understanding that once water quality standards are established (whatever they may be), all who discharge waste materials will do so under a permit issued by the Washington Pollution Control Commission. Please remember I am a taxpayer not a lawyer, but it is my impression that so long as the holder of such a disposal permit doesn't violate that permit, he is essentially immune to litigation from any party who feels he has suffered damage from waste materials discharged by the permit holder (3). As a taxpayer this seems to say that under these conditions if the waste from some source killed clams or oysters on my beach, I could not, under civil law, recover damages from the party who discharged the waste. Even if the permit were violated I would stand little chance of collecting damages unless I could scientifically prove beyond reasonable doubt that this particular waste was the proximate cause of loss (4).

In a less clear situation where perhaps my property value is depreciated due to unpleasant water color or a build up of sludge or silt, changing my sand or gravel beach to a mud hole, such as I have seen in several areas, my chances of economic recovery will indeed by very poor. Finally any aesthetic deterioration of my property - real or imagined is virtually beyond any type of recovery. Again I repeat I am not a lawyer but a concerned taxpayer with an investment to protect.

Assuming that pollution may affect the value of my property I must ask myself whether the proposed water quality standards will in fact protect my interests as a taxpayer. Therefore let's direct our attention to the proposed standards as taxpayers, not pollution biologists or engineers. It is my impression that with the possible exception of a few limited spots now looked on as waste "dilution" or "assimilation" zones, the standards proposed will bring about no significant reductions in either the quantity or quality of waste material presently discharged into our marine waters. In fact depending on methods of water sampling followed in implementation and enforcement of the final standards we might see increased pollution in some areas. This is very possible in those areas not presently receiving the dubious benefits of enrichment, which some people prefer, nay insist on, calling certain types of pollution. Since in my opinion no major improvement, and possible further deterioration of our marine water quality, may result from the proposed standards, the question resolves itself to whether I think the present water quality in the state is acceptable.

Now as a taxpayer and not a pollution expert, how can I decide whether present water quality is or is not satisfactory? Does the fact that oysters regularly reproduce successfully in the substantially unpolluted waters of

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Willapa Bay, South Puget Sound and Hood Canal, while areas receiving pollutants, namely Grays Harbor, the Straits of Juan de Fuca, North Puget Sound, Everett, Seattle, and Tacoma have little or no oyster setting tell me that some areas have excessive pollution at present? (5). Does the fact that oysters successfully reproduced in Grays Harbor prior to 1959 but have not since then, tell me something about too much pollution there? Does the fact that the only commercially valuable natural attachment of Pacific oysters recorded in Bellingham and Samish Bays took place when the major source of pollution in the area was shut down tell me we have too much pollution there? (6). Frankly as a taxpayer these facts cause me to believe we may already have excessive pollution in some areas.

I have considered possible pollution effects on the oyster because it is perhaps of the greatest interest to the waterfront owner for five reasons: First, since an oyster is a fish that swims like a rock, once it settles on or is placed on the beach, it can be considered the private property of the beach owner and the benefits accruing from this private ownership can be likened to those from an apple tree growing in my back yard; Second, of all the valuable animals one might find on the beach oysters and their close cousins the clams (not protozoa, plankton or fish eggs) are the ones most readily enjoyed; Third, I can buy oyster seed and plant it on my beach just as I can plant an apple tree in my yard; Fourth, toxicity of various waste materials have been measured with clam, mussel and oyster larvae by Okuba and Okuba in Japan (7). Dimick and Breese in Oregon (8), and Davis (9) in Connecticut; Fifth, oyster larvae have been routinely and successfully used to measure water quality in Washington waters (10).

As a taxpaying waterfront owner I summarize my position as follows:

1. I have a substantial investment in a type of property which has aesthetic and economic value to me (and a total market value of 1.4 billion dollars to the State of Washington).

2. These values have not escaped the eye of the tax collector who has invited me to pay a substantial share of the cost of government (based on my estimate - waterfront owners will pay at least $110,000,000 real estate taxes this year).

3. It seems that once standards are set (although it is said they could be revised in the future) and permits to pollute issued to those disposing of wastes, I will be stuck for any loss I might incur from a waste, so long as the standards are not violated by the permit holder.

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4. It appears to me that some biological damage may be occurring at present from existing pollution.

5. The proposed standards don't appear to greatly change the status quo and in effect may wind up legalizing pollution, now seen in limited areas, for all waters of the state.

6. Oysters and their larvae appear to give a measure of the toxicity of some of the wastes presently entering our state's waters.

Based on the view I have taken of the subject being considered, I must conclude that the proposed standards might not protect my waterfront property from devaluation and subsequent degradation to a "marine slum" due to pollution. Therefore I strongly urge that the standards proposed be considered as the minimum acceptable, and as reliable, reproducible, economically practical, biological measurements of water quality are developed - they be integrated into the standards as a part of the "appropriate bioassays" referred to in the proposed standards. As a start in this direction, I urge that bioassays with oyster larvae be written into the present standards as one of the "appropriate measures" to be employed in defining and evaluating water quality.

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Substantiative material for statement of Charles Woelke: 28 Feb. 67, Seattle, Washington.

1. Hagen, Carlos B. (1958) "Length of shoreline of Washington State." Dept. of Natl. Res., Bur. Serv. and Maps. Olympia, Wash.

2. Copy of 1967 tax statement of Charles E. Woelke for Tax No. 7, Sec. 30, Twn. 27, R. IW. (photocopy attached).

3. Ellison vs State of Wash. contesting waste disposal permit No. 779 dated Oct. 2, 1957 issued to Rayonier Inc., Shelton, Wash.

4. Jabine, William, Attn. at Law (1964) "Pollution Damage Not Easily Proved." (Olympia Oyster Co. vs Rayonier Inc., 229F. Supp. 855). Maine Coast Fisherman, October 1964.

5. Washington Department of Fisheries, Shellfish Laboratory spawning and setting reports for Willapa Bay and Puget Sound (annually since 1944).

6. "Natural setting of Pacific Oysters in Washington Waters in 1958". Washington Department of Fisheries Shellfish Laboratory, Brinnon, Wash. Nov. 12, 1958.

7. Okuba, K. and T. Okuba (1962) "Use of fertilized eggs of sea urchins and bivalves." Bull. Tokai Reg. Fish. Res. Lab. 32: 131-140.

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8. Dimick, R. E. and W. P. Breese (1965) "Bay mussel embryo bioassay." Proc. Twelfth Pac. N.W. Indust. Waste Conf., U. of W., Coll. Engr. Seattle, Wn.: 165-175.

9. Davis, Harry C. (1961) "Effects of some pesticides on eggs and larvae of oysters (Crassostrea gigas) and clams (Venus mercenaria)". Comm. Fish. Rev., vol. 23, No. 12, p 8-22.

10. Paulik, Gerald (1966) "Final statistical summary report on oyster larvae bioassay study." June 30, 1966.

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT D

State of Washington Department of Fisheries, Thor C. Tollefson, Director, Statement to Washington Pollution Control Commission on Proposed Water Quality Standards for Coastal waters from the mouth of the Hoh River to Tatoosh Island, Strait of Juan de Fuca from Tatoosh Island to a line between Fort Casey and Fort Flagler State Parks, presented at Public Hearing Port Angeles, Washington, December 15, 1966.

We appreciate the opportunity to present this statement of our interest for the water quality of the marine, estuarial and fresh waters from the Hoh River to Tatoosh

Island and Strait of Juan de Fuca from Tatoosh Island to a line between Fort Casey and Fort Flagler State Parks, and such other unidentified interstate ard/or coastal waters being considered at this hearing.

Ocean waters, including estuaries and bays too can be polluted. We take the position that close surveillance should be maintained on marine receiving waters as well as streams or lakes. There is little knowledge available on the long-term effects of emitted waste discharges upon the biota of these areas. There is a genuine need for such information. "Crash" investigations conducted in the past have uncovered major or immediate adverse conditions, but often failed to uncover the subtle or long-term effects on the biota. We are encouraged by the announcement that an extensive oceanographic research program is to be established in the Puget Sound area.

The Department of Fisheries in co-operation with the fishery agencies of Canada and in compliance with treaty obligations through the International Pacific Salmon Commission, and in co-ordination with the Pacific Marine Fisheries Commission, has promulgated regulations to control the harvest of food fish in both interstate and International waters as part of its statutory responsibilities of propagation, protection, conservation, preservation, and management of food fish and shellfish. Protection of water quality and quantity is also a necessary objective of the Department of Fisheries in terms of its statutory responsibilities. Clean waters are essential for protecting, maintaining, and managing our fisheries resource. We accept the following definition of the term "water pollution":

"The degradation or change of the physical, chemical, or biological qualities of surface or ground waters due to the activities of man, which adversely affect, directly or indirectly, the growth, reproduction, behavior, physiological condition, and survival of food fish and shellfish."

The foregoing definition of water pollution does not, in our opinion, preclude the discharge of treated waste materials into public waters provided such treatment is sufficient to prevent water quality impairment. We believe that all marine and estuarial waters of the State are food fish and shellfish areas. We also recognize that it may be necessary to establish minimal marine water areas for purposes of dilution of emitted waste matter. Establishment of a marine dilution area and the boundaries thereof will be based upon the quantity and type of discharge, current velocity, current direction, flushing rates and volume of the receiving water within the particular area. The Department of Fisheries should participate in the delineation of dilution areas in order to minimize their impact on food fish and shellfish. Likewise, water-quality standards for dilution areas should only be established after consultation with the Department of Fisheries. It is our view that any man-made deterioration of water quality is unacceptable unless the water user meets the burden of proving that such use would be non-injurious, directly or indirectly, to food fish and shellfish.

We believe that the use of the coastal waters (marine, esturial and fresh) from the Hoh River to Marrowstone Point by food fish (including anadromous species) and shellfish is a nonconsumptive, beneficial, and legitimate use of these waters and that such use is recognized by the Washington Pollution Control Commission. 1/

The coastal rivers and streams from the Hoh River to Port Townsand are important spawning and rearing areas for resident and anadromous salmonids. We feel it is imperative that high quality water be maintained in these

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1/ Reference: Information Bulletin, Water Quality Standards, Coastal waters from the mouth of the Hoh River to Tatoosh Island and Strait of Juan de Fuca from Tatoosh Island to a line between Fort Casey and Fort Flagler State Parks, Port Angeles, Washington, December 15, 1966, p. 13, Table 1. Washington State Pollution Control Commission.

streams. In addition to use of the stream areas, anadromous salmonids utilize such areas as Ozette, Pleasant, and Dickey lakes for rearing in addition to the estuaries and marine bays. Further, the Department of Fisheries is building a 1-million dollar Soleduck Salmon Production Development Station located in Clallam County, bordering the Soleduck River some 20 miles upstream from its confluence with the Pacific Ocean at La Push. The Department of Fisheries operates the Dungeness salmon hatchery on the Dungeness River, near Sequim. This station was built in 1902, rebuilt in 1945 and today operates as a 16-pond station, stocking fall chinook taken in the Elwha River and spring chinook and coho taken from the Dungeness. Rearing capacity at this station will accommodate 1.5-million yearling salmon and 2.2-million fingerling salmon. Published records on marine and anadromous food fish and shellfish are available in the Department's annual statistical reports, 1935 through 1965. Figures 1, 2, and 3 illustrate the marine and anadromous food fishing areas of the Pacific Ocean inside the 3-mile limit and the commercial salmon and bottom fishing areas from Tatoosh Island to Marrowstone Point. A brief illustration of the adult salmon sport landings and Indian catch of salmon in portions of the area under consideration is given herein.

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Area	Fishery	Range of annual landings (past 10 years)
Ozette River	Indian	700 to 2,800 fish
Quillayute River	"	4,800 to 25,700 fish
Queets River	"	9,300 to 21,500 fish
Quinault River	"	37,700 to 136,000 fish
Suez River and Waatch Creek	"	1,600 to 4,300 fish
Hoko River	"	1,100 to 3,800 fish
Hoh River	"	4,000 to 8,700 fish
Raft River	"	1,200 to 2,400 fish

The off-reservation sport fishery for salmon on the above named streams is on the upper reaches of the streams and amounts to about 1,800 salmon annually. Other important streams contributing to the ocean- and fresh-water fisheries are the Elwha, Dungeness, Pysht, Lyre, Bogachiel, Calawah, Clearwater, and Soleduck rivers.

The ocean-sport fishery for salmon and marine bottom fish constitutes an important aspect to the economy and recreational value of these waters. A summary of the landings is given herein.

Area	Species	Range of annual landings (past 10 years)
Neah Bay and Strait	Chinook salmon	18,000 to 46,000 fish
	Coho salmon	17,400 to 82,000 fish

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	Pink salmon	12,700 to	149,500 fish
	Bottomfish	over	4,700 fish
Sekiu-Pillar Pt.	Bottomfish	over	4,900 fish
East Juan de Fuca Strait	Bottomfish	over	15,500 fish
La Push	Chinook salmon	1,200 to	7,000 fish
	Coho salmon	2,900 to	20,000 fish
	Pink salmon	400 to	6,100 fish
	Bottomfish	over	3,900 fish

The surf or silver smelt at Kalaloch on the coast and in the Port Townsend and Dungeness area support an important commercial and sport fishery.

Commercial landings of salmon, bottomfish and shellfish are given in Tables 4 through 9, Appendix I.

Use by fish and shellfish of the marine and fresh-water area under consideration here is evident, but these stocks are being subjected to almost excessive stress by man's alteration of their natural environment. Favorable water quality conditions must be maintained throughout the various fresh-water phases of their life cycle.

Some of the water-quality factors affecting fish, shellfish and other aquatic life are temperature, dissolved oxygen, siltation, turbidity (light penetration), nutrient concentrations, and toxic materials. For example, bioassay's indicate adverse ecological conditions within

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Port Angeles Harbor wherein significant production of bivalve molluscs cannot be achieved (reference: Table VI, p. 30, Information Bulletin, Port Angeles, Washington, December 15, 1965, Washington Pollution Control Commission).

Successful propagation of anadromous fish in such protected areas as hatcheries, spawning channels, and special rearing ponds can be negated by the loss due to adverse natural environmental conditions encountered in the streams and estuarial waters on their seaward migration.

Water temperature extremes are a prime factor affecting the propagation, growth and habitat of food fish and shellfish. Optimal temperatures of marine and estuarial waters for shellfish range between 40 F and 68 F and water uses which would alter water temperatures beyond the normal seasonal fluctuation should not be permitted. Optimal temperature range for resident and anadromous fish in fresh water is 45 F to 60 F, with a range of 45 F to 55 F during spawning, incubation and hatching. Water temperature of marine and estuarial waters should not be altered more than 5% in the range between 40 F and 60 F.

Dissolved oxygen content of marine and estuarial areas for food fish and shellfish should be greater than 6 mg/1 throughout the year. Dissolved oxygen content of fresh-water areas utilized by resident and anadromous salmonids should be greater than 95% saturation throughout the year.

The water quality standards as proposed by the Washington State Pollution Control Commission for the coastal waters from the mouth of the Hoh River to Tatoosh Island and the Strait of Juan de Fuca from Tatoosh Island to a line between Fort Casey and Fort Flagler State Parks and such other unidentified interstate waters being considered at this hearing will generally meet the water-use needs of food fish and shellfish with some exceptions. The present recommended changes or additions are summarized in Tables 1 and 2 and we feel these standards are applicable to all the waters being considered at this hearing.

The complex interrelationship of fish and other aquatic organisms and their environment is not yet fully understood, but the total environment concept regarding aquatic organisms must be recognized. Therefore it is realized that water quality standards now recommended may not be permanent but will need reconsideration and possible revision at regular intervals in the future, but always providing for enhancement of the water resource.

Determination of water quality conditions in regard to accepted standards should be designed as to the where, when and how the samples should be obtained.

Further, the limit of deviation, if any, from a water quality standard should be specified at the time the standard is established. The standard method for analysis of marine waters should be the "Manual of Sea-Water Analysis", Strickland and Parsons, (1965) Bulletin No. 125, Fisheries Research Board of Canada.

Procedures included in "Standard Methods for the Examination of Water and Wastewater" should be employed for analysis of fresh water. We feel that other recognized methods that permit successful reproducibility of sample analysis are also acceptable; i.e., the use of bioassays for detection of materials that are at or near the lower limits of detectability included in "Standard Methods" or "Manual of Sea-Water Analysis". Measurement of water quality as it affects fish or shellfish is best demonstrated by the response of the organism to its environment. Whenever bioassays demonstrate adverse ecological conditions, results of these bioassays should take precedence and remedial action be initiated.

We do not believe that the answer to water quality problems lies in litigation of existing laws, but instead requires the co-operation of all concerned in a sincere and determined effort to abate pollution and enhance the quality of our water resource.

We encourage the support of the Washington Pollution Control Commission in obtaining additional funds and staff personnel required for their research, surveillance and enforcement program.

(See figures 1, 2 and 3, which follow:)

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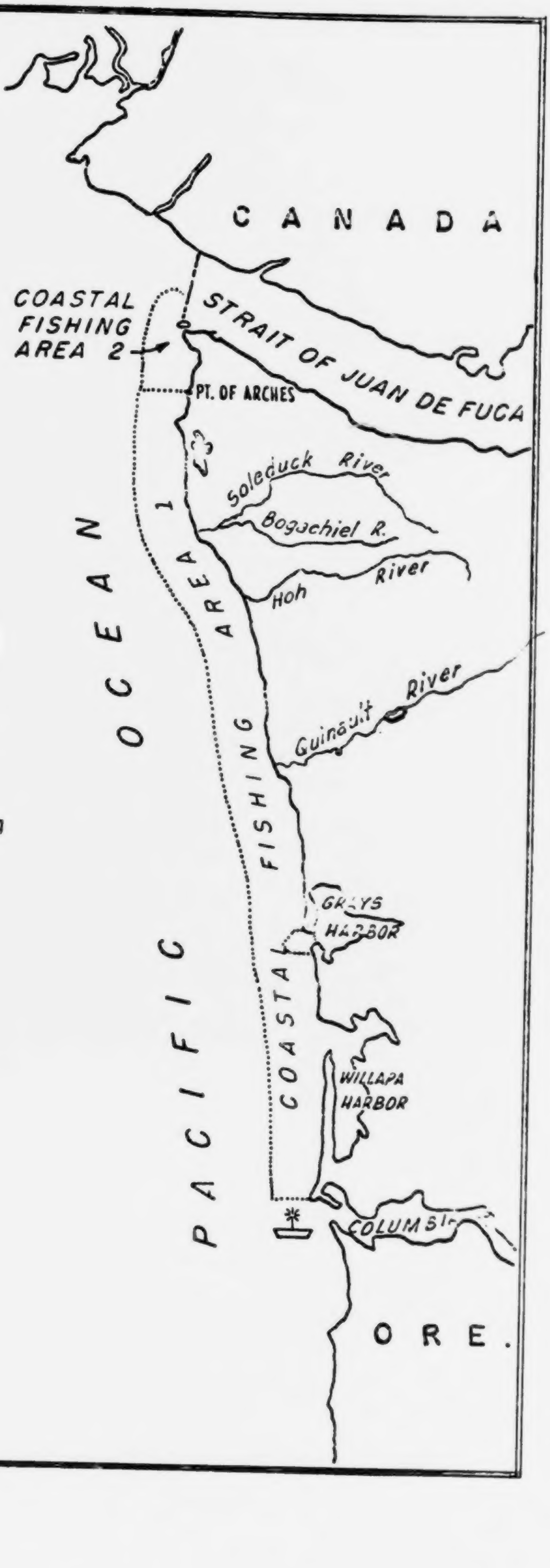
COASTAL FISHING AREAS

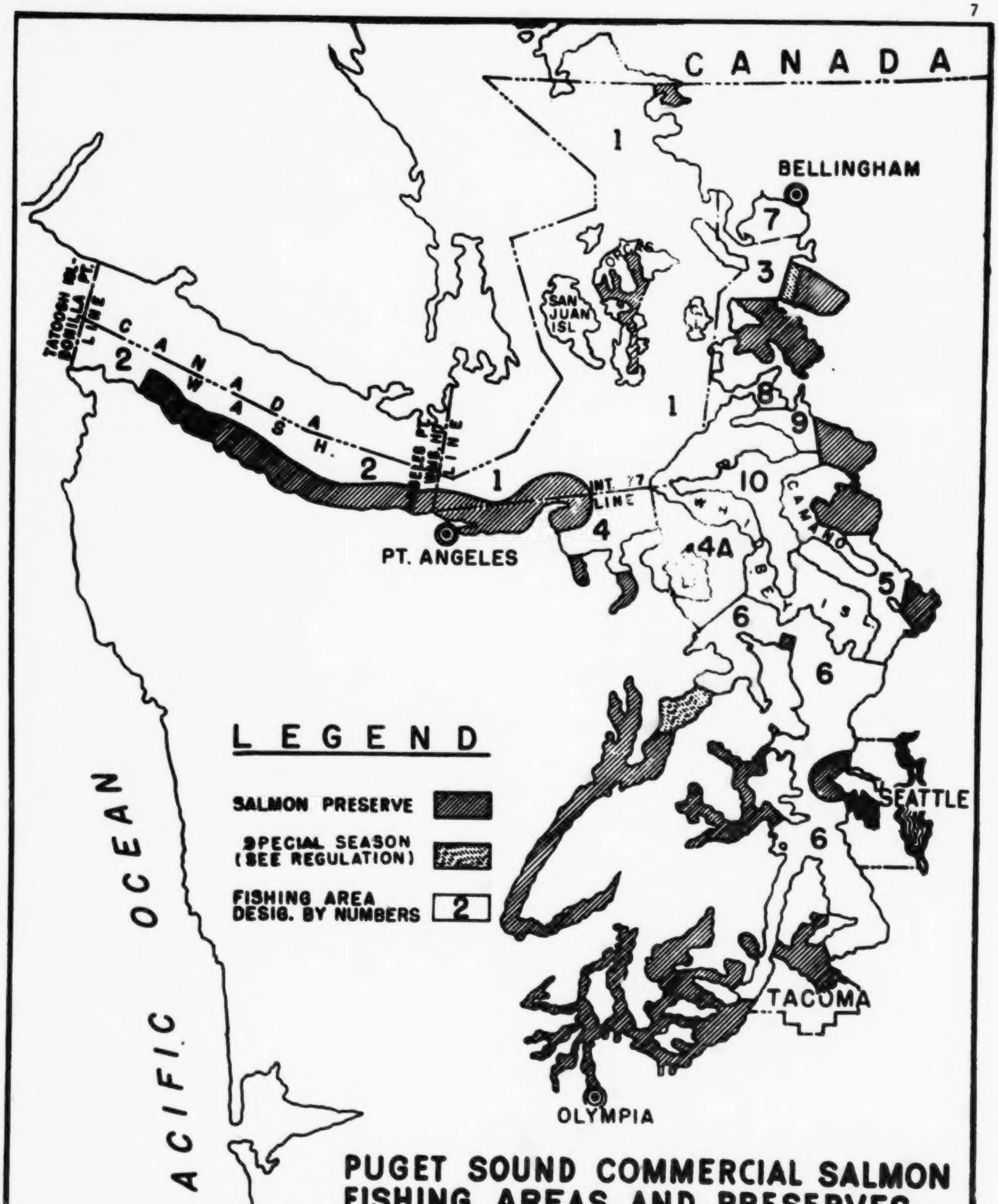
COASTAL FISHING AREA NO. 2 includes those waters of the Pacific Ocean inside the three-mile limit between the Point of Arches and a line drawn across the Strait of Juan de Fuca from Tatoosh Island Light to Bonilla Point on Vancouver Island.

COASTAL FISHING AREA NO. 1 includes those waters of the Pacific Ocean inside the three-mile limit between the Point of Arches and the mouth of the Columbia River, exclusive of Grays Harbor Fishing Area No. 2.



May, 1965

Figure 1.



PUGET SOUND COMMERCIAL SALMON FISHING AREAS AND PRESERVES

STATE OF WASHINGTON DEPT OF FISHERIES April 1966

Figure 2.

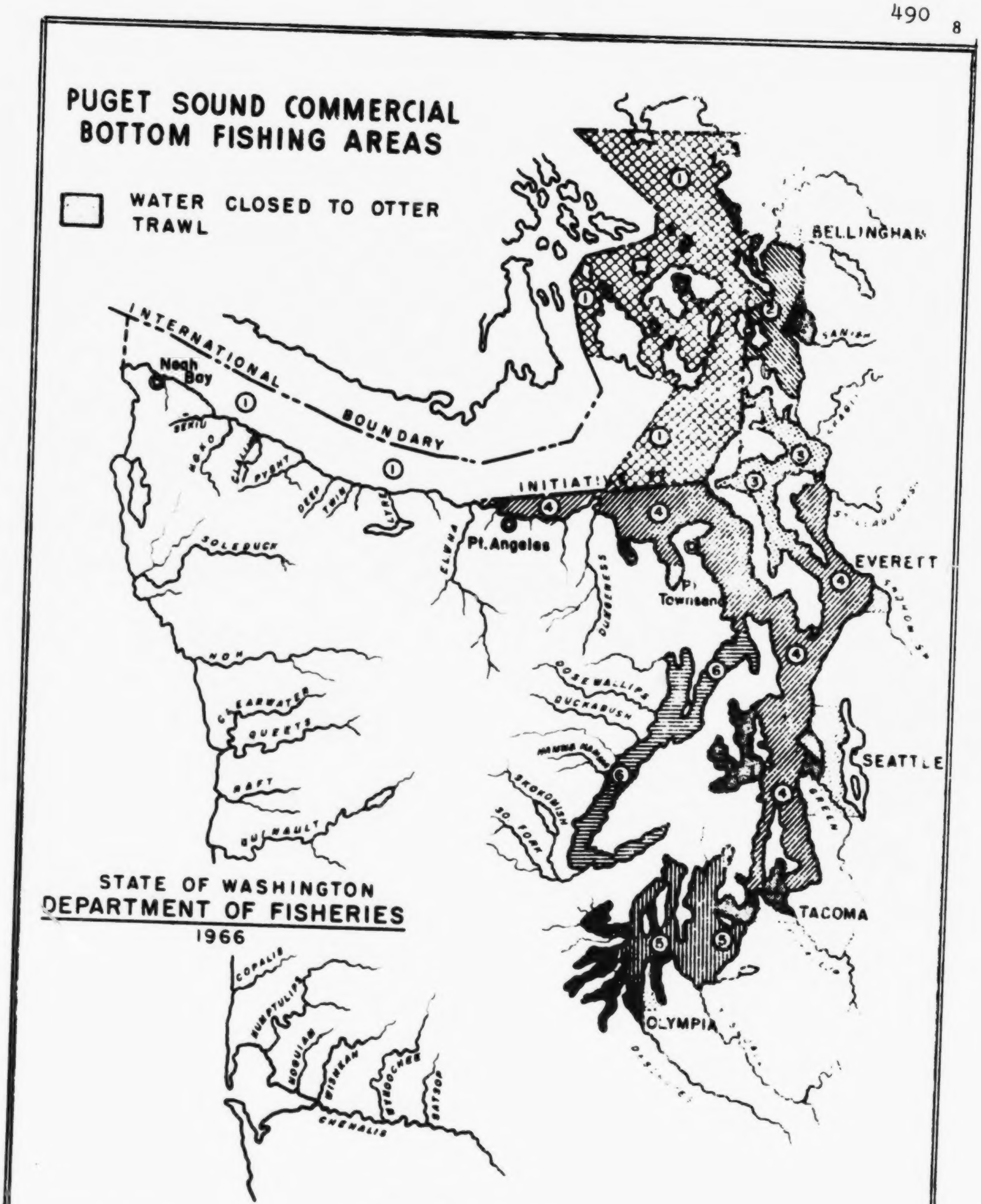

PUGET SOUND COMMERCIAL
BOTTOM FISHING AREAS
WATER CLOSED TO OTTER TRAWL
INTERNATIONAL BOUNDARY
Neah Bay
BELLINGHAM
SAMISH
SKAGIT
STILLAGUAMISH
INITIATIVE
Pt. Angeles
Pt. Townsend
EVERETT
SNOHOMISH
SEATTLE
GREEN
TACOMA
OLYMPIA
DESCHUTES
SEKIU
HOKO
PYSHT
DEEP
TWIN
LYRE
ELWHA
SOLEDUCK
DUNGENESS
HOH
CLEARWATER
QUEETS
RAFT
QUINAULT
DOSEWALLIPS
DUCKABUSH
HAMMA HAMMA
SKOKOMISH
SO. FORK
COPALIS
HUMPTULIPS
HOQUIAM
WISHKAH
WYNOOCHEE
SATSOP
CHEHALIS
1
2
3
4
5
6
STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
1966

Figure 3,

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT D

Table 1: WATER QUALITY STANDARDS FOR THE COASTAL WATERS FROM THE MOUTH OF THE HOH RIVER TO TATOOSH ISLAND AND STRAIT OF JUAN DE FUCA FROM TATOOSH ISLAND TO A LINE BETWEEN FORT CASEY AND FORT FLAGLER STATE PARTS

Water Use: Fish Propagation and Habitat (including the other aquatic and semi-aquatic life)

(Marine, estuarial, and fresh water as indicated.)

1. Organisms of the Coliform Group

(MPN or equivalent MF, using a representative number of samples where associated with fecal sources.)

Marine and estuary

Not to exceed limits specified in the National Shellfish Sanitation Program Manual of Operations, USPHS.

Fresh water

Consideration of the fishermen is required. Recommend the same parameters as for bathing, swimming, and recreational uses of water. (Average less than 240 per 100 ml and not exceed this in more than 20% of samples.)

2. Dissolved Oxygen (mg/l)

Marine and estuary

Greater than six (6) mg/l.

Fresh water

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Greater than 95% saturation with a minimum value of 7 mg/l. These values to be present at the diurnal and seasonal lows and when temperatures exceed 60 F (15.6 C).

3. pH

Marine and estuary

Hydrogen ion concentration expressed as pH. Between pH range of 7.8 and 8.5. Sudden changes of pH units of 0.5 or more should not occur as a result of man-made activities.

Fresh water

Hydrogen ion concentration expressed as pH. Between pH range of 6.5 and 8.5 unless historical natural values (conditions) lie outside that range. Sudden changes of pH values of 0.5 or more should not occur as a result of man-made activities.

4. Turbidity

Marine and estuary

Turbidity for marine and estuarial waters, upper 10 meters (32.5 ft) to be based upon vertical extinction coefficient. Standards should be coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. A Secchi disc may be used for determination of vertical extinction coefficient using the ratio of 1.7 divided by Secchi disc reading (Secchi disc reading in meters for a 30 centimeter diameter white disc) for blue light as developed by Poole and Atkins, 1929, Journal Marine Biological Association, United Kingdom (16).

No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above references.

In the deeper waters (mid-depth and bottom samples) Jackson Turbidity Units should be less than 25 attributable to materials resulting from man-made activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

Fresh water

Jackson Turbidity Units (JTU) of less than 5 attributable to materials in fresh-water streams resulting from man-caused activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

5. Temperature F(C)

Marine and estuary

Water temperature should not be altered more than 5% in the range between 40 F (4.4 C) and 60 F (15.6 C).

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Fresh water

Fresh water - If natural temperatures of the receiving waters are in excess of 60 F (15.6 C), no additive or use that will cause a higher temperature should be permitted. The optimal temperature range of fresh-water areas for salmonids is 45 F (7.2 C) to 60 F (15.6 C).

6. Dissolved Inorganic Substances

Marine, estuary and fresh water

Inorganic materials especially the ionic forms of heavy metals are deleterious to fish and other aquatic organisms. None should be discharged to the receiving waters that will create acute or chronic toxicity or significant ecological change. Reference: p: 423-426 "The Physiology of Fishes": and Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd. Control of abnormal enrichment from phosphates, etc.

7. Residues (fats, oils, grease, and floating solids, sludge deposits)

Marine, estuary and fresh water

Oils, tars, grease, animal fats: none allowable. It should be a consistent policy to eliminate oils, floating solids, suspended solids, sludge, and sediment before they can enter the receiving water. Includes earth or other materials from construction projects.

8. Sediment

Marine, estuary and fresh water

No deposition which adversely affects fish or shellfish propagation, growth, and habitat. Conditions ascribed to nature should be controlled wherever possible. Includes earth or other construction materials from road, dike, or culvert projects. Also debris from construction or operation of dams and reservoirs. Absence of sludge deposits.

9. Toxic or Other Deleterious Substances (pesticides, phenolics, and related organic and inorganic materials)

Marine, estuary and fresh water

None allowed from domestic, industry, agriculture or mining, including earth or other construction materials from road, bridge, dike, or culvert projects that will produce stress on aquatic organisms or result in a significant ecological change. Use of pesticides by any governmental or private entity to be stringently controlled. In no case shall pesticides or other material be allowed which could limit or prohibit the use of fish or shellfish for commercial or personal use. Absence of concrete leachings, etc.

Suggested reference: Water Quality Criteria,

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2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd.

10. Color

Marine estuary

To be based upon effective light penetration into the water as expressed by vertical extinction coefficient. Standards should be the coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above reference.

Fresh water

Fresh-water streams. The Platinum - Cobalt method is acceptable for determination of the true color, which should be less than 50 color units.

11. Radioactivity

Marine, estuary and freshwater

Current USPHS Drinking Water Standards except where concentration factors of aquatic flora and fauna exceed PHS reduction factors; then MPC of radioisotopes shall be reduced below acute or chronic problem levels. Conformance with U. S. Pure Food and Drug Administration standards.

12. Aesthetic Considerations (wastes

offensive to the senses of sight, taste, smell, or touch)

Marine, estuary and fresh water

Anything that is offensive to these senses should not be added to the receiving waters. Such wastes are nuisances to fishermen, although they may be innoxious to fish, shellfish or other aquatic organisms.

13. Dissolved Organics (settleable solids, sewage)

Marine, estuary and fresh water

Secondary treatment of sewage wastes is recommended. No excess nutrients that cause biological imbalance, slime, or other nuisance aquatic growth. Non-biodegradable materials should not be added to the receiving waters. Free chlorine to be at concentration equivalents below 0.05 mg/l of available chlorine (receiving water). Absence of foam.

14. Garbage, Agricultural and Other Similar Wastes

Marine, estuary and fresh water

The waters of the State of Washington should not be used for the disposal of garbage, agricultural or other similar wastes. No garbage or similar wastes, or drainage from land disposal areas should enter the receiving waters.

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15. Water Control Structures

Marine and estuary

No structure or alteration of flow should be allowed that will modify natural conditions by more than 5% of their maximum value in respect to water temperatures, salinity, tide range, and tidal velocity. Changes beyond this magnitude may be considered only if it can be conclusively shown that the proposed change will result in enhancement of water quality and will not cause an ecological upset.

Fresh water

Restrictions as to dams, ditches, and other uses of waters and waterways shall be as set forth in Titles 43 and 75, Revised Code of Washington, Chapger 75.20, 1966 and such other chapters of the Fisheries Code applicable.

Table 2: WATER QUALITY STANDARDS FOR THE COASTAL WATERS FROM THE MOUTH OF THE HOH RIVER TO TATOOSH ISLAND AND STRAIT OF JUAN DE FUCA FROM TATOOSH ISLAND TO A LINE BETWEEN FORT CASEY AND FORT FLAGLER STATE PARTS

Water Use: Shellfish Growth and Propagation (Marine and estuarial waters.)

1. Organisms of the Coliform Group (MPN or equivalent MF, using a representative

number of samples where associated with fecal sources.)

Not to exceed limits specified in the National Shellfish Sanitation Program Manual of Operations, USPHS.

2. Dissolved Oxygen (mg/l)

Greater than six (6) mg/l in the larval stage. Greater than 5 (5) mg/l in the adult stage.

3. pH

Hydrogen ion concentration expressed as pH. Between pH range of 7.8 and 8.5. Sudden changes of pH units of 0.5 or more should not occur as a result of man-made activities.

4. Turbidity

Turbidity for marine and estuarial waters, upper 10 meters (32.5 ft) to be based upon vertical extinction coefficient. Standards should be coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. A Secchi disc may be used for determination of vertical extinction coefficient using the ratio of 1.7 divided by Secchi disc reading (Secchi disc reading in meters for a 30 centimeter diameter white disc) for blue light as developed by Poole and Atkins, 1929, Journal Marine Biological Association, United Kingdom (16).

No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above references.

In the deeper waters (mid-depth and bottom samples) Jackson Turbidity Units should be less than 25 attributable to materials resulting from man-made activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

5. Temperature F(C)

Water temperature should not be altered more than 5% in the range between 40 F (4.4 C) and 60 F (15.6 C). When natural conditions are above 68 F (20 C) man-made activity should not result in discharge raising the average water temperature in the dilution area more than 1%.

6. Dissolved Inorganic Substances

Inorganic materials especially the ionic forms of heavy metals are deleterious to fish and other aquatic organisms. None should be discharged to the receiving waters that will create acute or chronic toxicity or significant ecological change. Reference: p: 423-426 "The Physiology of Fishes": and Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd. Control of abnormal enrichment from phosphates, etc.

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7. Residues (fats, oils, grease, and floating solids, sludge deposits)

Oils, tars, grease, animal fats: none allowable. It should be a consistent policy to eliminate oils, floating solids, suspended solids, sludge, and sediment before they can enter the receiving water. Includes earth or other materials from construction projects.

8. Sediment

No deposition which adversely affects fish or shellfish propagation, growth, and habitat. Conditions ascribed to nature should be controlled wherever possible. Includes earth or other construction materials from road, dike, or culvert projects. Also debris from construction or operation of dams and reservoirs. Absence of sludge deposits.

9. Toxic or Other Deleterious Substances (pesticides, phenolics, and related organic and inorganic materials)

None allowed from domestic, industry, agriculture, or mining, including earth or other construction materials from road, bridge, dike, or culvert projects that will produce stress on aquatic organisms or result in a significant ecological change. Use of pesticides by any governmental or private entity to be stringently controlled. In no case shall pesticides or other material be allowed which could limit or prohibit the use of fish or shellfish for commercial or personal use. Absence of concrete leachings, etc.

Suggested reference: Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd.

10. Color

To be based upon effective light penetration into the water as expressed by vertical extinction coefficient. Standards should be the coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above reference.

11. Radioactivity

Current USPHS Drinking Water Standards except where concentration factors of aquatic flora and fauna exceed PHS reduction factors; then MPC of radioisotopes shall be reduced below acute or chronic problem levels. Conformance with U. S. Pure Food and Drug Administration standards.

12. Aesthetic Considerations (wastes

offensive to the senses of sight, taste, smell, or touch)

Anything that is offensive to these senses should not be added to the receiving waters. Such wastes are nuisances to fishermen, although they may be innoxious to fish, shellfish, or other aquatic organisms.

13. Dissolved Organics (settleable solids, sewage)

Secondary treatment of sewage wastes is recommended. No excess nutrients that cause biological imbalance, slime, or other nuisance aquatic growth. Non-biodegradable materials should not be added to the receiving waters. Free chlorine to be at concentration equivalents below 0.05 mg/l of available chlorine (receiving water). Absence of foam.

14. Garbage, Agricultural and Other Similar Wastes

The waters of the State of Washington should not be used for the disposal of garbage, agricultural, or other similar wastes. No garbage or similar wastes, or drainage from land disposal areas should enter the receiving waters.

15. Water Control Structures

No structure or alteration of flow should be allowed that will modify natural conditions by more than

5% of their maximum value in respect to water temperatures, salinity, tide range, and tidal velocity. Changes beyond this magnitude may be considered only if it can be conclusively shown that the proposed change will result in enhancement of water quality and will not cause an ecological upset.

Restrictions as to dams, ditches, and other uses of waters and waterways shall be as set forth in Titles 43 and 75, Revised Code of Washington, Chapter 75.20, 1966 and such other chapters of the Fisheries Code applicable.

Appendix I

PORT ANGELES AREA SPORT FISHERY DATA (1960-66)

Port Angeles enters our catch information as one of the major launching sites in our East Juan de Fuca Strait statistical area (Punch card area 6 - defined as: waters from Tongue Point east to Point Wilson, including waters off west Whidbey Island north of Point Partridge). The 1960 through 1965 sport fishery catch data for Area 6 is given in Table 1. In this area there are several other launching locations, but only two others of any real importance at this time: the Agate and Cresent Beach - Freshwater Bay area, and Coronet Bay in Deception

Pass.

It would be very difficult to come up with accurate figures showing the importance of Ediz Hook in numbers of fish landed, because anglers in this area many times launch at one location and run to another to fish. It is possible, however, to indicate the relative importance of each of the major launching sites to the angling public, through a check of the average number of anglers sampled at each place during a period when all were in operation. This period would be roughly from June through September and is presented in Table 2. From October through May Port Angeles is the only major site operating within punch card Area 6 as the other locations are somewhat seasonal and launch very few boats during the fall-winter-early spring period.

As you will note, in Table 3 I have shown the salmon catch and number of angler trips for the June through September period (1964 and 1965) for all of Area 6 so that a comparison can be made between the angling intensity during this period and the relative importance of each of the major areas. The majority of the remaining catch and anglers trips (October through May) can safely be said to be connected with the Port Angeles area.

There is a sport fishery of varying intensity

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around Ediz Hook proper throughout the entire year. The fishery inside the bay is concentrated mainly during the winter months (approximately late November through early February).

Table 1. Sport fishery catch data - punch card area 6 (East Juan de Fuca Strait).

	Calculated catch					
Year*	Chinook	Coho	Pink	Total	Calculated angler trips	Catch/ angler trip
1960	800	400	0	1,200	7,200	0.17
1961	1,900	600	300	2,800	17,900	0.16
1962	6,700	600	0	7,300	19,200	0.38
1963	6,700	7,700	49,100	63,500	51,800	1.23
1964	10,800	3,100	0	13,900	72,300	0.18
1965	15,100	5,400	3,000	23,500	86,900	0.27

* 1960 through 1963 - calculated from catch sampling and boat house reports. 1964 and 1965 - calculated from catch sampling and punch card returns.

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Table 2. Sport fishery catch data - punch card area 6 (East Juan de Fuca Strait).

Average number of anglers per sample

June-Sept.	Port Angeles	Agate & Crescent Beach-Freshwater Bay	Coronet Bay Deception Pass
1964	56	23	(no data)
1965	47	61	28
1966	67	61	15

Table 3. Sport fishery catch data - punch card area 6 (East Juan de Fuca Strait).

June-Sept.	Calculated salmon catch	% of yearly total	Calculated angler trips	% of yearly total
1964	10,254	75%	61,410	85%
1965	17,843	76%	69,921	80%
1966	(no data at this time)	-	(no data at this time)	-

(See tables 4, 5, 6, 7, 8 and 9, which follow:)

Table 4. Port Townsend Area Fish Catches 1961-65
In Number of Pounds

Species	Gear	1961	1962	1963	1964	1965
Chinook	GN	35	120	1,951	208	304
"	PS	10,435	2,131	63.278	2,558	32,144
Chum	GN	6,941	12,991	31,342	19,560	12,405
"	PS	63,056	108,130	79,809	191,182	102,875
Pink	GN	2,860	--	102,316	10	6,333
"	PS	116,693	--	2,474,192	--	115,024
Silver	GN	32,280	37,653	38,044	32,498	13,768
"	PS	86,787	65,034	58,374	63,374	147,818
Sockeye	GN	21	--	145	--	20
"	PS	257	--	2,738	6	174
Sturgeon	OT	--	21	125	--	--
Shad	OT	--	110	89	527	--
Halibut	T	--	--	125	139	--
Dover sole	OT	1,860	7,426	4,557	45	--
English sole	OT	39,547	186,979	80,697	76,061	52,979
Rock sole	OT	20,374	11,409	9,352	2,082	2,371
Sand sole	OT	5,962	2,500	3,085	--	3,595
Rex sole	OT	--	--	52	--	--
Petrale sole	OT	335	2,067	2,370	2,963	--
Flounder	OT	4,333	33,810	4,125	8,215	3,425
Turbot	OT	600	--	--	--	--
Black cod	OT	--	88	15	--	--
Ling cod	PS	--	--	--	--	17
" "	OT	10,853	33,295	13,925	18,254	4,226
" "	T	64,130	48,303	27,890	56,412	27,905
True cod	OT	110,767	333,213	523,394	418,447	117,711
" "	T	--	--	--	--	102
" "	SN	--	4,370	--	--	--
Tomcod	OT	--	180	2,500	4,200	605
Rockfish	OT	9,446	32,338	113,605	56,674	7,629
"	T	85	29	--	167	43
Surf perch	OT	72	2,663	87	590	96
Mink food	OT	--	--	7,550	1,150	--
Skate	OT	4,077	10,996	4,110	9,810	--
Ratfish	OT	103,100	19,400	--	--	23,100
Scrapfish	OT	228,950	148,740	79,550	--	569,040
Octopus	OT	183	1,469	1,442	322	80
Butter clams	Sh	13,119	16,746	14,451	10,538	11,501
" "	Dr	--	--	--	680	18,240
Little Neck clams	Sh	116,865	86,113	71,421	62,396	60,215
" " "	Dr	15,159	67	--	--	16,680
Horse clams	Dr	--	--	--	--	1,920
Pac Hlshl clams	Sh	3,189	5,554	6,143	2,604	6,341
Smelt, Killisut	BS	--	1,098	--	--	--

Table 5. Port Angeles Area Fish Catches 1961-65
In Number of Pounds

Species	Gear	1961	1962	1963	1964	1965
Chinook	GN	416	70	462	1,727	267
"	PS	16	--	--	--	--
"	T	--	--	--	--	44
Chum	GN	26	20	356	--	7
Pink	GN	2,552	--	54,116	29	964
"	PS	292	--	--	--	--
Silver	GN	12,482	1,745	3,323	1,345	1,180
"	PS	15	--	--	--	--
Sockeye	GN	15,866	6,693	34,607	7,808	6,370
"	PS	17	--	--	--	--
Sturgeon	OT	--	--	--	--	45
Shad	OT	18	--	--	--	28
"	GN	--	68	--	--	--
Halibut	T	479	165	885	261	170
"	HL	--	77	--	--	--
Dover sole	OT	22	--	--	--	970
English sole	OT	11,220	13,897	--	7,555	52,724
Petrale sole	OT	2,048	--	110	5,468	4,518
" "	T	--	--	--	3	--
Rock sole	OT	3,246	370	--	425	5,969
Sand sole	OT	--	--	--	--	70
Flounder	OT	140	2,765	--	--	10,475
Turbot	OT	--	--	--	--	4,310
Black cod	OT	--	9	--	--	782
Ling cod	GN	41	16	59	18	54
" "	OT	8,542	670	--	--	12,418
" "	T	166,712	67,749	78,707	67,939	62,879
" "	HL	15,428	6,946	905	386	580
True cod	OT	64,211	4,552	6,270	40,192	207,613
" "	SN	7,670	--	--	--	--
Rockfish	GN	305	--	--	6	19
"	OT	19,364	260	--	9,323	34,311
"	T	4,138	905	939	1,667	823
"	HL	403	874	60	49	--
Surf perch	OT	--	--	--	--	198
Skate	OT	6,660	516	--	--	17,799
"	T	62	--	--	--	--
Mink Food	OT	--	--	--	8,865	--
Octopus	OT	--	225	45	--	398
"	HL	--	--	98	--	--
"	Pot	--	77	--	--	--

Table 6. Discovery Bay Area Fish Landings 1961-65
In Number of Pounds

Species	Gear	1961	1962	1963	1964	1965
Chinook	GN	229	83	3,585	5,511	7,548
"	PS	1,707	120	83,099	83	57,916
Chum	GN	26,083	26,874	66,433	128,066	100,724
"	PS	21,981	33,069	50,195	77,151	139,677
Pink	GN	539	--	95,776	--	11,829
"	PS	3,927	--	1,010,299	--	48,770
Silver	GN	26,894	19,472	19,569	36,651	50,115
"	PS	9,631	3,872	11,707	10,139	63,872
Sockeye	GN	16	11	469	--	69
"	PS	13	--	2,403	--	1,132
English sole	OT	56,977	18,435	18,470	46,650	53,794
Petrale sole	OT	57	--	--	--	--
Rex sole	OT	6	--	--	--	--
Rock sole	OT	9,784	10,580	1,975	6,207	7,365
Sand sole	OT	4,363	--	890	--	3,770
Flounder	OT	10,433	4,332	140	17,056	5,870
Turbot	OT	1,555	--	--	--	290
Ling cod	OT	5,460	400	--	934	2,163
" "	T	--	--	3,800	--	--
" "	PS	--	--	10	--	--
True cod	OT	35,530	29,230	28,843	65,103	116,965
Tomcod	OT	12	--	300	5,320	4,590
Pollack	OT	--	--	--	100	--
Rockfish	OT	4,279	1,648	1,530	5,896	8,317
"	GN	--	--	--	16	--
Surf perch	OT	175	38	--	480	--
Octopus	OT	203	538	50	210	90
"	Pot	--	2,569	--	--	--
Skate	OT	62	1,600	120	--	--
Mink food	OT	240	--	--	--	--
Scrapfish	OT	--	--	--	--	18,805
Butter clams	Sh	3,881	26,781	4,944	2,208	8,000
Little Neck clams	Sh	281,427	351,203	292,316	234,166	3,924
Pac Hdsal clams	Sh	1,194	273	807	--	295,851
Oysters		14,499	142	502	--	46

Table 7. **Sequim** Bay-Washington Harbor Fish Landings 1961-65
In Number of Pounds

Species	Gear	1961	1962	1963	1964	1965
Butter clams	Sh	15,859	18,032	20,159	19,467	8,302
" "	Dr	35,192	2,655	1,130	1,233	--
Little Neck clams	Sh	234,620	227,438	201,217	177,913	84,912
" " "	Dr	113,252	17,099	24,153	16,791	--
Pac Hdshl clams	Sh	350	--	--	--	--
Horse clams	Sh	50	--	--	--	--
Oysters		--	--	18	--	--

Table 8. Dungeness Area Fish Landings 1961-65
In Number of Pounds

Species	Gear	1961	1962	1963	1964	1965
Ling cod	T	194	216	--	--	291
Smelt	BS	1,106	10,082	1,321	2,352	1,729
Octopus	Pot	13,682	80,367	25,399	25,504	24,673
Crab	Pot	21,410	12,179	13,835	11,271	5,372
Butter clams	Sh	--	--	--	--	150
Little Neck clams	Sh	--	--	--	--	8,658
Oysters		--	--	--	--	53,229

Table 9. Washington State Cape Johnson-Cape Flattery and Strait of Juan de Fuca Salmon Landings, 1965, In Number of Pounds

Species	Gear	Strait of Juan de Fuca	Cape Johnson-Cape Flattery
Chinook	GN	7,020	559
	PS	1,532	545
	T	4,091	454,450
Chum	GN	5,142	--
	PS	291	--
	T	27	1,270
Pink	GN	77,647	--
	PS	39,089	--
	T	4,412	518,289
Silver	GN	235,925	38
	PS	23,032	83
	T	14,057	3,086,421
Sockeye	GN	54,450	--
	PS	3,279	--
	T	22	950

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E

State of Washington Department of Fisheries, Thor C. Tollefson, Director, Statement to Washington Pollution Control Commission on Proposed Water Quality Standards for Puget Sound waters north of Port Townsend and Mukilteo, Skagit River, Sumas River, presented at Public Hearing Mount Vernon, Washington, February 9, 1967.

We appreciate the opportunity to present this statement of our interest for the water quality of the marine, estuarial and fresh waters of Puget Sound north of Port Townsend and Mukilteo, including the Sumas River, Nooksack River, Skagit River, Stillaguamish River, the Snohomish River and such other unidentified interstate and/or coastal waters being considered at this hearing.

Marine waters, including estuaries and bays too can be polluted. We take the position that close surveillance should be maintained on marine receiving waters as well as streams or lakes. Evaluation of the biological productivity of the marine and estuarial waters of northern Puget Sound indicates the tremendous food production potential of these waters, and that only a small portion of the potential is presently being utilized. There is little knowledge available on the long-term effects of emitted waste discharges upon the biota of these areas. There is a genuine need for such information. "Crash" investigations conducted in the past have uncovered major or immediate adverse conditions, but often failed to uncover the subtle or long-term effects on the biota. We are encouraged by the announcement that an extensive oceanographic research program is to be established in the Puget Sound area. We feel that additional research on water quality conditions is also needed.

The Department of Fisheries in co-operation with the fishery agencies of Canada and in compliance with treaty obligations through the International Pacific Salmon Commission, and in co-ordination with the Pacific Marine Fisheries Commission, has promulgated regulations to control the harvest of food fish in both interstate and International waters as part of its statutory responsibilities of propagation, protection, conservation, preservation, and management of food fish and shellfish. Protection of water quality and quantity is also a necessary objective of the Department of Fisheries in terms of its statutory responsibilities. Clean waters are essential for protecting, maintaining, and managing our fisheries resource. We accept the following definition of the term "water pollution":

"The degradation or change of the physical, chemical, or biological qualities of surface, ground, and

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E

marine waters due to the activities of man,which adversely affect, directly or indirectly, the growth, reproduction, behavior, physiological condition, and survival of food fish and shellfish."

The foregoing definition of water pollution does not, in our opinion, preclude the discharge of treated waste materials into public waters provided such treatment is sufficient to prevent water quality impairment. We believe that all marine and estuarial waters of the State are food fish and shellfish areas. Because total and immediate clean-up of each waste is difficult we recognize that it may be necessary to establish minimal marine water areas for purposes of dilution of emitted waste matter on an interim basis. However, continuing reduction of all sources of wastes should be required to the end that dilution areas established could be reduced or eliminated. Establishment of a marine dilution area, including its location and delineation is a complex problem and each area should be considered as a separate entity. Limiting factors on the quantity, concentration and type of discharge should include but not be limited to the biota present, velocity, direction and transport (volume) of water currents, vertical mixing of the water, flushing rate, volume and chemical characteristics of the water

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E

area, and the additive or synergistic effects of other wastes in the receiving water. The Department of Fisheries should participate in the delineation of dilution areas because of biological considerations that are paramount and necessary in order to minimize the impact of emitted waste on food fish and shellfish. Likewise, water-quality standards for dilution areas should only be established after consultation with the Department of Fisheries. It is our view that any man-made deterioration of water quality is unacceptable unless the water user meets the burden of proving that such use would be noninjurious, directly or indirectly, to food fish and shellfish.

We believe that the use of the waters (marine, estuarial and fresh) of northern Puget Sound by food fish (including anadromous species) and shellfish is a nonconsumptive, beneficial, and legitimate use of these waters and that such use is recognized by the Washington Pollution Control Commission. 1/

1/ Reference: Information Bulletin, Proposed Water Quality Standards for Puget Sound waters north of Port Townsend and Mukilteo, the Skagit River, Sumas River, Mount Vernon, Washington, February 9, 1967, pp 13-18, Tables I through VI. Washington State Pollution Control Commission.

The marine and estuarial waters of North

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E

Puget Sound, along with the inter-tidal and sub-tidal areas of the marine bays and harbors, are extensively utilized for the propagation and habitat of bottomfish, shellfish and other marine organisms. All of which contribute to the industrial, recreational, and general economy of the State.

Anadromous salmonids utilize the main body of marine waters for rearing and as transport water in addition to the estuaries, bays and fresh-water streams.

An extensive commercial fishery for food fish and shellfish, plus the sports fishery, occurs in the waters of north Puget Sound. Commercial landings of bottomfish, salmon, and shellfish for the waters of north Puget Sound are available in the statistical report printed annually by the Department. Additional statistics on the following areas are presented herein: Everett-Port Susan-Saratoga Pass (Table 1). Blaine-Gulf of Georgia (Table 2), Bellingham Bay, Samish Bay-Rosario Straits (Table 3), North Puget Sound (Point Roberts-Rosario Straits)(Table 4), Bellingham-Nooksack (Table 5), San Juan-Salmon Banks (Table 6), Skagit Bay (Table 7), Anacortes-Padilla Bay (Table 8), and West Beach (Table 9). Statistics on the sport fishery catches of salmon are given in Tables 10, 11, and 12. Figures 1 and 2 illustrate the marine fishing areas for bottomfish and salmon in Puget Sound.

Use by fish and shellfish of the marine, estuarial, and fresh-water area under consideration here is evident, but these stocks are being subjected to almost excessive stress by man's alteration of their natural environment. Favorable water quality conditions must be maintained throughout the various phases of their life cycle. Successful propagation of anadromous fish in such protected areas as hatcheries, spawning channels, and special rearing ponds can be negated by the loss due to adverse environmental conditions encountered on their seaward migration, including the stream, estuarial and marine waters.

Alteration of the aquatic environment by man's steady progress toward higher levels of urbanization and industrialization has required more stringest regulation of both the commercial and sports fisheries. This is especially applicable to the salmon fishery resource. The Department of Fisheries now operates four salmon hatcheries and three spawning beaches* to supplement the stream production of chinook and coho salmon in north Puget Sound. Production at these stations has been increased from 50,000 lb. in 1956 to 150,000 lb. of fish in 1965 (Table 13). This increased production coupled with other management practices necessary to maintain the stocks within exploitable levels has been achieved at considerable increase in cost to the taxpayer. We fully appreciate their interest in maintaining these fisheries. Hatchery production of pink and chum salmon has not yet proven feasible and maintenance of these stocks is even more critical. For example, studies of pink salmon in recent years by Department personnel revealed that the adult spawning escapement in certain stream areas of the Snohomish River where they were once abundant, now no longer occurs. In 1963 the Puget Sound pink salmon run was the largest on record, yet it was necessary to place emergency restrictions on the Port Susan-Port Gardner fishery in September to assure an adequate escapement to the Snohomish River. This closure was enacted at the expense of permitting an undesirable over escapement to the Stillaguamish River. Despite this emergency action the pink salmon escapement to the Snohomish was considered inadequate to provide the recruitment needed to increase this stock. Juvenile pink salmon do occur in abundance in Everett harbor as indicated by studies in 1962 conducted by the Pollution Control Commission biologists. Further they found that almost instantaneous mortalities of young salmon occurred in the inner harbor on several occasions during the study period (spring, 1962 and 1963). The most prevalent periods of acute toxicity occurred during minus low tides. We feel that poor water quality conditions have not been eliminated as a direct or indirect factor influencing Snohomish River salmon production.

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* Sockeye

The co-operative State-Federal Study and conference precceding the study in the Bellingham-Anacortes area attest to the existence of poor water quality conditions which at times endanger the survival of food fish and shellfish, and to marginal conditions which seldom cause directly observable fish losses, but can result in significant losses over extended periods by reduction of survival rates of fish and shellfish and prevent achieving their maximum potential production and growth. We expect the complete results of this co-operative study (Washington State Enforcement Project) will soon be published.

We recognize and acknowledge with deep appreciation the increased co-operation between governmental agencies, industries, and the public regarding water pollution abatement. However, it would appear that any gain made in the abatement of water pollution in north Puget Sound apparently has been largely overshadowed by the expansion of industry, urbanization, and the population growth. The waste discharge, quality effect sources, treatment needs, and results of oyster larvae bioassay [1] indicate the problem of water pollution in north Puget Sound is by no means solved. (Selected references to the water pollution problems in north Puget Sound are given in Appendix I).

We offer our compliments to the Washington Pollution Control Commission and its staff for their work in initiating the water quality standards proposed for the marine, estuarial and fresh waters being considered at this hearing. We feel the proposed standards will generally meet the water-use needs of food fish and shellfish with some exceptions. Our present recommended changes or additions, which we feel more adequately consider the biological aspects, are summarized herein (Tables 14 and 15).

The complex interrelationship of fish and other aquatic organisms and their environment is not yet fully understood, but the total environment concept regarding aquatic organisms must be recognized. Therefore it is realized that water quality standards now recommended may not be permanent but will need reconsideration and possible revision at regular intervals in the future, but always providing for enhancement of the water resource.

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[1] Information Bulletin, Proposed Water Quality Standards for Puget Sound waters north of Port Townsend and Mukilteo, the Skagit River, Sumas River. Mount Vernon, Washington, February 9, 1967, Tables VII and XII. Washington Pollution Control Commission.

Determination of water quality conditions in regard to accepted standards should be designed as to the where, when, and how the samples should be obtained. Further, the limit of deviation, if any, from a water quality standard should be specified at the time the standard is established. The standard method for analysis of marine waters should be the "Manual of Sea-Water Analysis", Strickland and Parsons, (1965) Bulletin No. 125, Fisheries Research Board of Canada.

Procedures included in "Standard Methods for the Examination of Water and Wastewater" should be employed for analysis of fresh water. We feel that other recognized methods that permit successful reproducibility of sample analysis are also acceptable; i.e. the use of bioassays for detection of materials that are at or near the lower limits of detectability included in "Standard Methods" or "Manual of Sea-Water Analysis". Measurement of water quality as it affects fish or shellfish is best demonstrated by the response of the organism to its environment. Whenever bioassays demonstrate adverse ecological conditions, results of these bioassays should take precedence and remedial action be initiated.

We do not believe that the answer to water quality problems lies in litigation of existing laws, but instead requires the co-operation of all concerned in a sincere and determined effort to abate pollution and enhance the quality of our water resource.

We encourage the support of the Washington Pollution Control Commission in obtaining additional funds and staff personnel required for their research, surveillance and enforcement program.

(See tables 1 to 13, inclusive, and figures 1 and 2, which follow:)

Table 1. Everett-Port Susan-Saratoga Pass
Fish Landings in Number of Pounds

Year	Chinook	Chum	Pink	Silver	Sockeye	Sturgeon	Herring	Candlefish
1965	150,250	34,138	362,318	578,998	567	211	100,856	639
64	78,845	166,472	37	450,570	-	-	90,104	179
63	68,048	55,419	1,690,116	194,642	50	50	38,967	-
62	54,787	75,992	9	602,619	-	81	115,841	-
61	143,435	59,105	397,752	637,337	34	25	111,076	1,344
1960	77,687	25,514	10	82,666	70	18	140,331	278
59	38,930	343,821	516,610	194,944	83	15	277,693	28
58	74,041	263,570	31	493,055	280	-	177,792	670

Year	Shad	Smelt	Bellingham Sole	Dover Sole	English Sole	Petrale Sole	Rock Sole	Sand Sole	Misc. Sole
1965	-	14,841	-	14,065	576,440	-	14,362	-	-
64	-	4,758	-	-	703,611	1,810	6,590	1,940	-
63	-	38,205	-	1,455	707,040	-	6,791	1,950	-
62	-	22,438	880	14,640	559,492	4,775	4,335	895	-
61	-	34,708	-	12,410	534,460	-	36,859	6,504	1,644
1960	38	24,566	168	1,850	576,263	-	23,933	1,845	-
59	-	14,064	-	11,048	545,718	-	7,172	692	-
58	-	7,603	-	52,032	546,601	-	11,032	-	40

Year	Flounder	Sablefish	Ling Cod	True Cod	Rockfish	Surf Perch	Hake	Ratfish
1965	63,312	-	1,035	29,797	20,748	35,846	735,200	229,850
64	48,381	-	4,854	80,059	25,162	13,577	--	387,700
63	190,940	-	4,545	68,547	25,682	33,759	--	80,300
62	83,492	-	15,599	96,628	26,283	8,652	--	411,680
61	90,090	1,397	26,030	89,607	23,474	24,178	--	315,817
1960	151,744	-	13,949	81,145	61,940	10,638	--	27,900
59	44,592	-	12,607.	172,902	39,195	13,255	--	--
58	13,414	14	11,320	216,941	9,966	5,216	--	80,240

Year	Skate	Dogfish & Scrap	Mink Food	Crab	Octopus	Shrimp	Bonito
1965	1,365	569,040	--	33,753	-		-
64	585	256,400	--	35,709	153	5,942	-
63	--	45,500	--	23,399	145	4,170	9
62	5,193	367,920	540	28,659	620	5,123	-
61	3,282	158,583	580	26,496	72	2,484	-
1960	5,940	303,850	1,440	21,721	387	5,610	-
59	4,327	940,972	--	10,853	717	--	-
58	3,237	973,287	--	27,749	921	3,743	-

State of Washington
DEPARTMENT OF FISHERIES
Statistics
12/14/66

Table 2.

Blaine-Gulf of Georgia Landings
Including Sucia-Waldron Catch Areas
In Number of Pounds

Year	General Sole	Butter Sole	Dover Sole	English Sole	Rock Sole	Sand Sole	Flounder	Black Cod	Ling Cod	True Cod	Rockfish	Surf Perch
1954	2,125	1,500	1,804	385,522	17,086	7,994	80,105	--	248,206	800,184	20,892	795
1955	8,045	15,195	--	420,890	1,327	16,367	159,733	--	104,394	602,637	7,225	35
1956	18,724	6,795	1,625	327,620	1,410	4,374	127,337	2,380	97,527	581,104	42,230	368
1957	1,570	5,296	6,786	416,256	6,440	6,675	175,063	1,445	132,192	731,993	8,662	360
1958	340	7,720	18,531	622,196	12,134	8,221	330,222	--	134,547	1,112,604	11,047	1,209
1959	4,965	1,124	9,728	563,691	14,119	7,102	72,999	--	105,592	1,002,120	10,878	--
1960	3,484	1,626	3,238	619,007	35,988	18,862	358,063	80	121,244	647,674	12,742	60
1961	1,180	11,379	1,210	336,786	13,171	19,401	281,604	--	137,056	472,554	7,987	635
1962	--	1,005	250	286,181	1,850	6,582	193,574	2,140	106,624	853,371	5,771	110
1963	--	1,205	--	592,916	2,492	17,110	325,191	--	83,437	1,090,672	11,324	2,455
1964	--	--	--	691,676	11,388	19,500	250,136	10	132,466	1,011,835	12,898	2,060
1965	--	--	--	740,184	1,165	3,147	358,512	275	101,201	990,729	13,065	330

Year	Sturgeon	Halibut	Herring	Smelt	Dogfish	Other Shark	Turbot	Hake	Ratfish	Skate	Scrapfish	Mink Feed
1954	--	1,173	--	--	695,966	500	3,400	545	630,174	714,246	105,020	--
1955	--	629	--	--	482,110	--	--	5,660	742,277	452,065	151,936	--
1956	30	1,061	--	--	160,185	--	13,315	--	697,408	180,421	778,700	--
1957	--	141	577,915	--	442,780	--	3,560	--	713,029	177,292	779,285	11,495
1958	--	743	7,642,200	3,604	760,650	2,150	29,980	13,700	809,363	269,430	1,104,115	906
1959	30	1,054	3,353,490	3,523	1,223,800	2,820	114,388	72,800	1,629,440	376,518	450,445	290
1960	51	37	808,219	5,365	817,295	2,250	177,172	75,593	847,125	250,645	297,860	108,746
1961	26	105	39,295	5,335	537,250	--	63,793	138,920	467,410	203,285	139,946	121,845
1962	20	172	--	2,075	552,500	6,300	12,868	184,662	528,500	120,659	270,725	791,419
1963	35	30	2,336,675	1,505	511,406	--	43,918	104,202	640,100	119,150	435,355	1,141,125
1964	20	--	827,300	4,283	1,336,450	1,800	23,220	258,847	832,700	129,920	--	843,377
1965	--	--	1,702,550	250	1,830,880	600	25,015	224,737	1,060,900	39,562	261,100	1,365,955

(Continued)

Table 2. (Continued)

Blaine-Gulf of Georgia Landings
Including Sucia-Waldron Catch Areas
In Number of Pounds

Year	Clams	Crabs	Octopus	Shrimp	Squid	Pollack	Tom Cod	Petrale Sole	Rex Sole	Greenling	Porpoise
1954	24,808	686,529	2,801	--	210	--	--	--	--	--	--
1955	35,569	685,888	1,149	--	--	--	--	119	--	--	--
1956	1,106	311,197	1,648	--	--	60	--	8,870	60	--	--
1957	--	198,349	4,298	--	322	--	--	405	--	20	--
1958	185	170,724	5,526	--	8	--	160	--	--	--	600
1959	3,512	173,969	5,793	--	--	--	--	315	--	--	--
1960	5,287	558,598	805	--	--	--	1,020	1,133	455	--	--
1961	2,308	978,709	1,121	--	--	--	150	95	--	--	--
1962	5,638	496,758	12,066	--	--	--	8,270	--	--	--	--
1963	132	585,749	10,825	--	--	22,709	2,045	3,802	--	--	--
1964	1,548	709,666	1,875	--	--	1,675	12,248	260	--	--	--
1965	--	739,588	1,576	--	--	42,207	29,243	--	--	--	--

Table 3.

Bellingham Bay-Samish Bay
Rosario Straits
In Number of Pounds

Year	General Sole	Butter Sole	Dover Sole	English Sole	Rock Sole	Sand Sole	Flounder	Black Cod	Ling Cod	True Cod	Rockfish	Surf Perch
1954	--	13,900	--	89,489	--	2,025	34,845	--	20,494	186,642	1,115	85
1955	--	3,965	180	110,907	--	--	42,538	--	15,449	160,874	470	--
1956	23,039	8,497	345	149,523	180	--	44,891	--	13,734	188,699	955	--
1957	--	4,315	--	68,610	--	1,501	40,248	--	6,808	109,228	870	35
1958	--	14.015	365	126,361	--	4,250	51,946	--	31,597	261,900	958	--
1959	--	840	725	114,504	1,332	--	54,108	--	47,300	197,917	2,330	--
1960	--	24,127	--	114,997	534	3,903	61,520	380	19,488	54,814	5,789	--
1961	--	39,671	450	71,204	528	10,844	79,861	--	22,982	49,159	453	--
1962	--	13,403	--	144,439	--	20,789	117,244	15	15,515	76,152	1,132	180
1963	--	2,115	--	100,875	720	3,658	49,424	--	13,677	122,518	1,344	--
1964	--	--	--	196,490	500	6,130	44,480	--	28,475	160.404	2,246	--
1965	--	--	--	85,978	--	--	57,445	--	12,857	117,541	1,311	1,438

(Continued)

Bellingham Bay-Samish Bay
Rosario Straits
In Number of Pounds

Table 3. (Continued)

Year	Sturgeon	Halibut	Herring	Smelt	Dogfish	Other Shark	Turbot	Hake	Ratfish	Skate	Scrapfish	Mink Feed
1954	--	325	--	--	50,250	--	--	750	8,015	71,520	27,425	--
1955	12	--	--	--	220,830	400	--	--	26,845	63,080	35,295	--
1956	--	--	--	--	58,850	--	--	--	2,200	147,965	208,839	--
1957	18	--	572	--	20,410	1,110	--	--	--	51,375	86,565	12,140
1958	148	56	58,800	--	31,520	--	400	--	--	56,025	213,155	1,160
1959	109	--	1,503,910	--	32,200	--	600	--	5,600	27,250	112,635	226
1960	92	35	2,819,672	319	13,800	--	2,030	--	11,845	9,222	28,110	74,427
1961	153	--	2,722,445	--	34,850	--	844	--	--	2,532	--	117,730
1962	255	--	5,742,435	529	5,900	--	1,950	--	3,000	3,174	--	133,810
1963	41	--	4,185,690	--	--	--	1,090	310	--	--	--	148,005
1964	169	--	2,398,200	--	42,500	--	--	--	6,600	1,270	78,751	270,763
1965	48	--	5,769,218	--	38,100	1,500	--	--	3,600	--	--	238,225

Year	Clams	Crabs	Octopus	Shrimp	Squid	Pollack	Tom Cod	Petrale Sole
1954	3,098	154,989	232	--	--	--	-	450
1955	383	68,465	185	--	--	--	-	--
1956	2,558	50,365	878	--	--	220	-	--
1957	--	60,661	602	--	--	--	-	90
1958	--	153,080	1,545	8,054	--	--	-	--
1959	--	231,093	1,403	242	--	--	-	--
1960	359	396,395	--	110	--	--	-	--
1961	1,531	478,988	338	4,403	--	--	-	365
1962	834	373,529	2,093	1,910	--	1,060	-	--
1963	1,558	760,758	433	4,788	--	--	-	--
1964	710	669,945	380	3,507	--	--	-	--
1965	2,233	586,859	38	--	3,237	--	--	--

North Puget Sound Salmon Landings
In Number of Pounds

Table 4. POINT ROBERTS

Year	Chinook	Chum	Pink	Coho	Sockeye
1954	395,914	486,001	289	452,355	16,034,097
1955	324,133	372,361	7,171,426	497,106	2,408,407
1956	245,943	135,680	998	559,725	2,326,102
1957	267,883	70,660	6,619,030	256,328	3,620,311
1958	236,681	255,664	5,098	447,896	13,282,221
1959	346,917	305,965	4,213,386	273,254	4,043,986
1960	280,709	207,342	362	160,585	2,606,467
1961	196,346	135,302	762,932	264,272	3,054,309
1962	134,148	65,278	180	510,437	1,831,667
1963	257,084	87,226	2,883,875	232,165	3,316,915
1964	320,180	112,405	207	578,176	1,264,140
1965	289,320	32,136	1,173,826	332,639	2,686,368

ROSARIO STRAITS

Year	Chinook	Chum	Pink	Coho	Sockeye
1954	32,534	142,045	73	94,232	2,432,280
1955	41,622	225,609	1,746,908	114,463	748,758
1956	64,320	61,544	105	168,063	1,178,778
1957	44,919	11,454	635,637	59,494	1,310,509
1958	50,391	81,107	1,449	144,065	4,556,445
1959	49,292	67,872	326,560	49,715	1,358,449
1960	58,584	17,900	158	35,368	1,403,595
1961	73,114	32,876	492,573	137,666	1,445,826
1962	47,906	15,083	128	163,987	1,469,621
1963	51,705	20,859	772,212	44,282	926,561
1964	50,469	10,114	245	133,149	404,093
1965	65,601	3,854	259,950	80,957	697,885

Table 5. BELLINGHAM-NOOKSACK

Year	Chinook	Chum	Pink	Coho	Sockeye
1954	53,763	377,490	--	156,525	54
1955	105,112	320,944	65,388	150,898	96
1956	131,323	132,381	--	230,933	220
1957	124,774	444,093	35,764	89,678	--
1958	135,229	591,666	80	148,624	1,124
1959	114,145	599,870	36,382	157,245	1,714
1960	164,453	64,918	10	89,589	675
1961	154,275	151,395	271,833	233,562	3,683
1962	116,584	135,646	9	243,909	712
1963	214,660	88,428	421,733	71,548	2,106
1964	351.219	79.757	27	174.591	268
1965	269,151	23,566	38,455	157,012	1,991

Samish Bay - Similk Bay, 1951 through 1965, Range of Pacific oyster production in gallons, 48,000 to 106,000 gallons.

Table 6. San Juan Islands-Salmon Banks Fish Landings in Number of Pounds

Year	Chinook	Chum	Pink	Coho	Sockeye	English Sole	Rock Sole	Sand Sole	Flounder	Bellingham Sole
1961	60,130	88,530	892,295	276,919	2,817,919	910	1,178	1,160	825	-
1962	29,219	61,647	185	440,362	1,288,751	650	--	670	2,115	300
1963	79,132	47,153	4,036,946	193,483	2,641,120	5,524	--	--	735	-
1964	54,653	66,733	1,127	626,264	1,103,677	4,710	400	--	450	-
1965	49,493	46,092	970,642	357,202	2,090,101	25,263	--	--	6,630	-

Year	Ling cod	True cod	Rockfish	Sablefish	Surf Perch	Herring	Smelt	Halibut	Mink Food	Ratfish
1961	140,495	993	285	--	--	34,145	315	37	--	--
1962	98,865	--	584	--	--	48,859	289	427	--	10,150
1963	48,460	12,101	1,369	1,958	2,590	30,028	--	--	1,565	--
1964	46,111	570	3,727	--	3,915	38,956	235	--	752	--
1965	56,058	15,520	10,320	--	1,290	182,885	3,285	--	1,530	--

Year	Clams	Crabs	Octopus	Scallops	Shrimp
1961	-	22,038	59	1,608	1,258
1962	-	--	36	--	--
1963	686	--	110	--	987
1964	-	--	--	--	1,920
1965	-	3,568	--	--	1,925

Table 7. Skagit Bay Fish Landings in Number of Pounds

Year	Chinook	Chum	Pink	Coho	Sockeye	Smelt	Herring	Candlefish	Ling Cod	Surf Perch
1961	580,120	162,604	718,994	324,971	1,535	8,029	1,715	-	-	25
1962	301,841	142,191	19	317,847	6,845	9,765	1,395	-	242	55
1963	417,624	193,250	3,673,413	228,425	20,894	26,380	905	100	45	84
1964	432,332	137,682	10	181,773	4,391	23,359	-	-	-	264
1965	692,265	15,495	269,241	142,342	1,607	15,764	-	-	-	-

Year	Clams	Crabs	Shrimp
1961	--	59,196	--
1962	2,695	80,349	--
1963	1,331	130,554	2,870
1964	89	96,392	1,815
1965	--	73,916	3,965

Table 8. Anacortes-Padilla Bay Fish Landings in Number of Pounds

Year	Smelt	Sturgeon	English Sole	True Cod	Surf Perch	Clams	Crabs
1961	7,974	-	-	-	168	-	30,863
1962	14,603	-	-	-	-	-	22,797
1963	68,357	33	-	-	1,471	68	14,786
1964	10,811	-	1,370	470	90	142	40,613
1965	5,300	-	-	-	-	165	106,901

Table 9. West Beach Fish Landings in Number of Pounds

Year	Chinook	Chum	Pink	Coho	Sockeye	Dover Sole	English Sole	Rock Sole	Sand Sole	Flounder
1961	88,201	66,296	584,215	298,901	653,737	40	5,660	-	-	325
1962	72,645	58,423	51	228,905	321,186	-	-	405	328	85
1963	185,122	122,596	9,793,395	172,012	599,441	-	1,420	-	-	-
1964	116,099	94,712	392	215,333	186,158	-	-	-	-	-
1965	211,060	14,366	396,368	211,662	371,831	-	-	-	-	-

Year	Ling Cod	True Cod	Rockfish	Octopus	Dogfish	Herring	Petrale Sole
1961	7,265	2,690	230	-	-	-	85
1962	29,542	150	-	-	-	-	-
1963	2,562	1,995	-	70	-	-	-
1964	736	-	-	-	9,050	217,250	-
1965	3,461	-	100	-	-	216,250	-

Table 10. Sport fishery catch data - punch card Area 7 (San Juan Islands - marine waters north of Deception Pass).

Year*	Calculated catch			Total	Calculated angler trips	Catch/angler trip
	Chinook	Coho	Pink			
1960	1,300	2,500	0	3,800	16,300	0.23
1961	3,700	24,900	5,900	34,500	89,200	0.39
1962	14,500	29,500	0	44,000	259,400	0.17
1963	29,200	59,200	50,600	139,000	299,400	0.46
1964	9,000	7,200	0	16,200	137,500	0.12
1965	6,900	7,500	4,300	18,700	97,700	0.19

* 1960 through 1963 - calculated from catch sampling and boathouse reports.
1964 and 1965 - calculated from catch sampling and punch card returns.

Table 11. Sport fishery catch data - punch card Area 8 (Skagit Bay and Deception Pass).

Year*	Calculated catch			Total	Calculated angler trips	Catch/angler trip
	Chinook	Coho	Pink			
1960	1,700	300	0	2,000	11,000	0.18
1961	2,500	900	800	4,200	21,700	0.19
1962	300	0	0	300	7,500	----
1963	900	0	0	900	23,100	0.04
1964	3,600	2,000	0	5,600	63,100	0.09
1965	4,900	4,000	1,400	10,300	69,000	0.15

* 1960 through 1963 - calculated from catch sampling and boathouse reports.
1964 and 1965 - calculated from catch sampling and punch card returns.

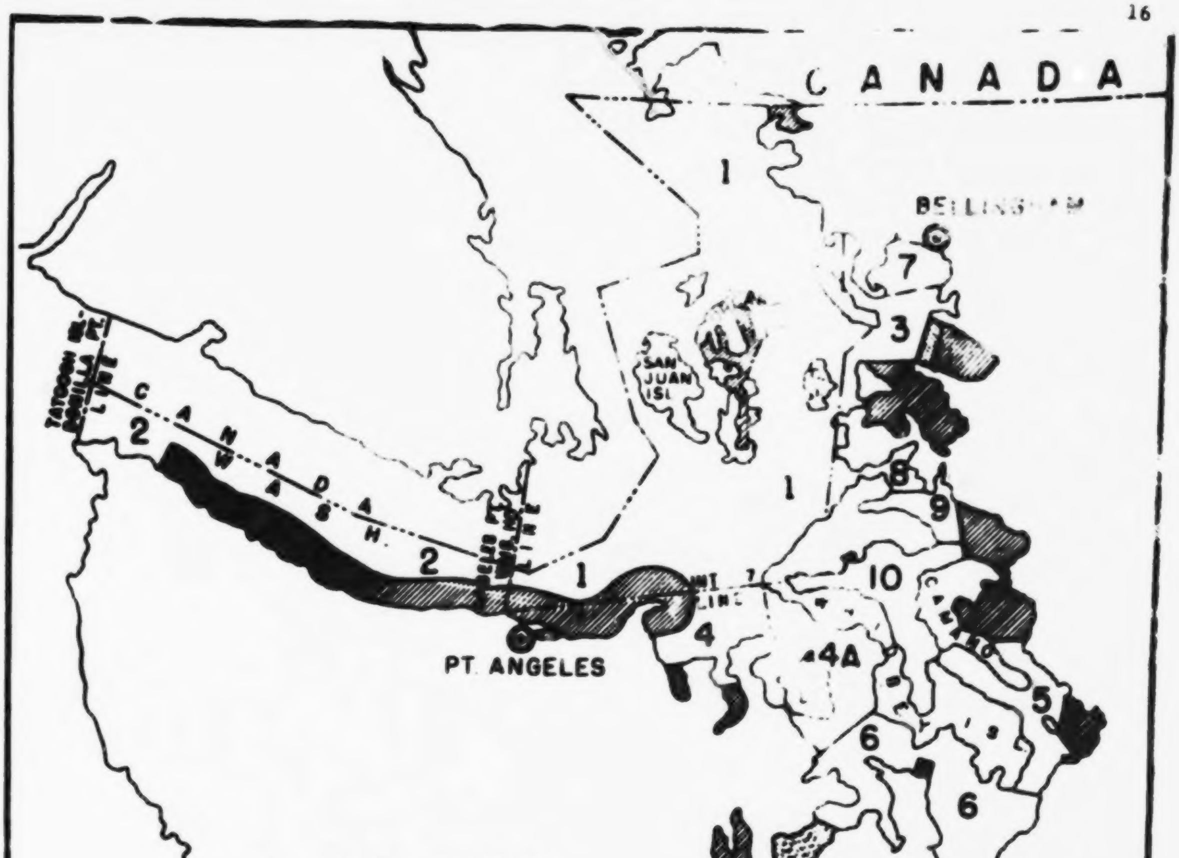
Table 12. Sport fishery catch data - punch card Area 9 (Admiralty Inlet, Possession Sound, Saratoga Passage, and Port Susan).

Year*	Calculated catch			Total	Calculated angler trips	Catch/angler trip
	Chinook	Coho	Pink			
1960	36,200	28,400	0	64,600	225,100	0.29
1961	46,200	39,700	14,800	100,700	303,400	0.33
1962	36,400	29,500	0	65,900	183,700	0.36
1963	50,300	65,900	207,000	323,200	369,900	0.87
1964	12,600	27,700	0	40,300	153,800	0.26
1965	13,100	28,700	16,200	58,000	160,600	0.36

* 1960 through 1963 - calculated from catch sampling and boathouse reports.
1964 and 1965 - calculated from catch sampling and punch card returns.

Table 13. Production of chinook and coho salmon (pounds of fish) at the four northern Puget Sound salmon hatcheries (WDF), 1956 through 1965.

Calendar Year	Hatcheries				Total Pounds
	Nooksack	Samish	Skagit	Skykomish	
1956	8,272	11,054	21,314	8,978	49,618
1957	15,505	8,188	29,467	12,073	65,233
1958	17,529	12,787	27,224	20,319	77,859
1959	19,792	11,698	24,320	12,768	68,578
1960	9,326	13,399	22,795	15,332	60,852
1961	20,904	12,755	39,285	21,717	94,661
1962	21,288	14,806	35,447	30,912	102,453
1963	29,869	14,480	23,678	7,396	75,423
1964	25,313	25,258	52,634	31,098	134,303
1965	49,009	29,238	31,369	38,805	148,421
Total Pounds	216,807	153,663	307,533	199,398	877,401



PUGET SOUND COMMERCIAL SALMON FISHING AREAS AND PRESERVES

STATE OF WASHINGTON DEPT OF FISHERIES

April 1966

Figure 1.

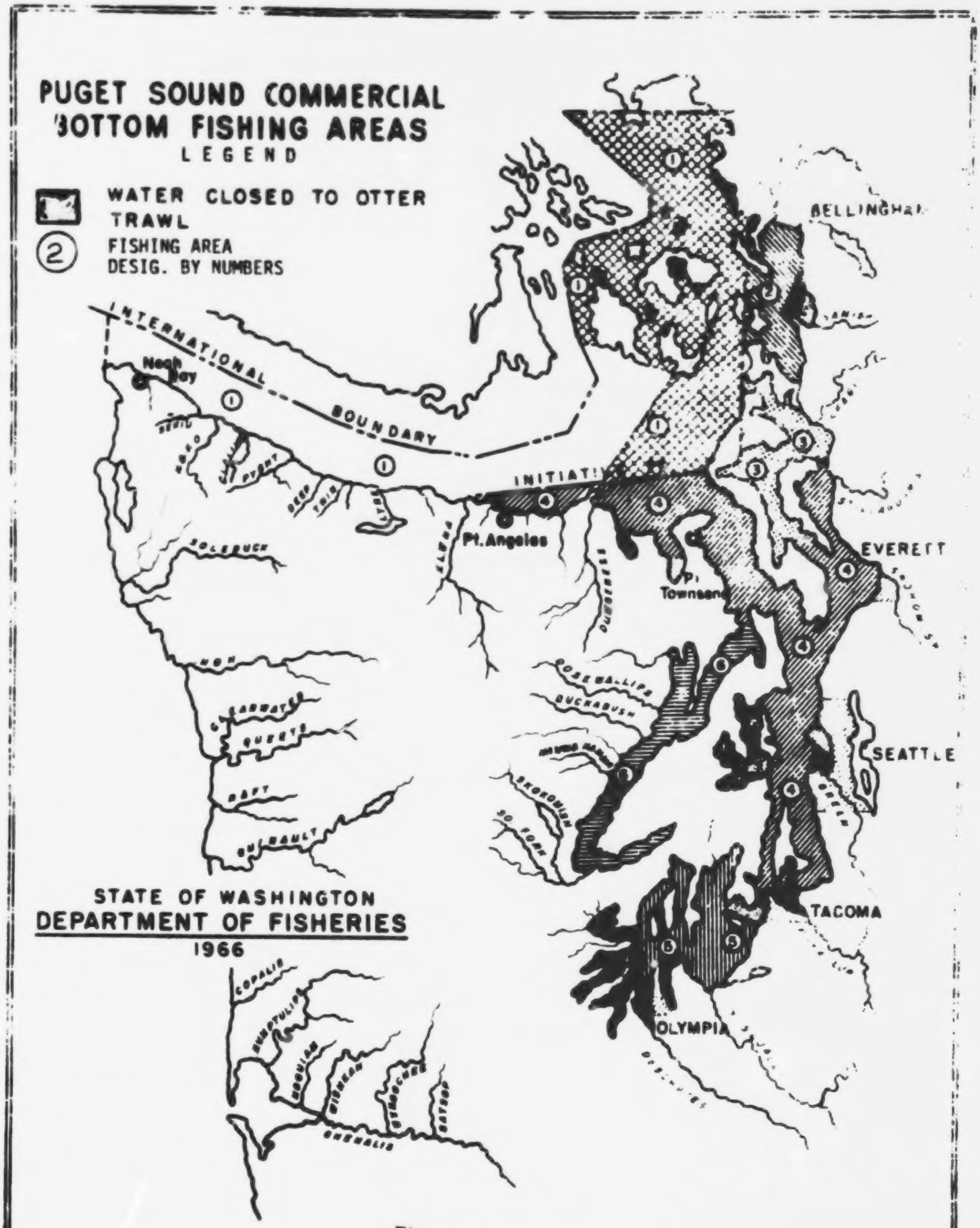

PUGET SOUND COMMERCIAL
BOTTOM FISHING AREAS
LEGEND
WATER CLOSED TO OTTER TRAWL
② FISHING AREA DESIG. BY NUMBERS
INTERNATIONAL BOUNDARY
Neah Bay
Pt. Angeles
Pt. Townsend
BELLINGHAM
EVERETT
SEATTLE
TACOMA
OLYMPIA
STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
1966
SOLEDUCK
HOH
QUEETS
QUINAULT
COPALIS
HUMPTULIPS
CHEHALIS
DUCKABUSH
SKOKOMISH
SO. FORK
GREEN

Figure 2.

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APPENDIX I

Selected References to Information and Water Quality Problems in Northern Puget Sound

Williams, R. C.; E. M. Mains; W. E. Eldridge; J. E. Lasater 1953. Toxic Effects of Sulfite Waste Liquor on Young Salmon. Wash. Dept. Fish., Res. Bull. No. 1.

Lasater J. E. 1953 Effects of Sulfite Waste Liquor on Salmon Food Organisms. Pacific Marine Fisheries Commission, manuscript

Holland, G. A.; J. E. Lasater; E. D. Newmann; W. E. Eldridge 1960 Toxic Effects of Organic and Inorganic Pollutants on Young Salmon and Trout. Wash. Dept. Fish., Res. Bull. No. 5, Sept. 1960

Gunter, Gordon; Jack Edward McKee "On Oysters and Sulfite Waste Liquor" Wash. Poll. Control Comm., Feb. 1960 (p. 71 - Bellingham, etc.)

Statement by Roy M. Harris, Director, Washington State Pollution Control Commission to Natural Resources and Power Subcommittee of the House Committee on Government Operations, November 22, 1963, Seattle, Washington, 3-5, 12-14, 22 p.

Joint Federal-Washington State Pollution Control Conference, "Pollution of Waters of Puget Sound, Strait of Juan de Fuca, tributaries and Estuaries",

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E

Transcript of conference, vol I, II, III, Olympia, Washington, January 17, 1962

Reports on Sulfite Waste Liquor in a Marine Environment and its Effect on Oyster Larvae, Wash. Dept. Fish., Res. Bull. No. 6, Dec., 1960

Washington State Enforcement Project, U.S. P.H.S., Div. Water Supply and Pollution Control and Wash. State Poll. Control Comm., Progress Reports, Nov. 13, 1964 and October 1, 1965 through June 30, 1966

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Table 14. PUGET SOUND WATERS NORTH OF PORT TOWNSEND AND MUKILTEO, INCLUDING THE SUMAS RIVER, NOOKSACK RIVER, SKAGIT RIVER, STILLAGUAMISH RIVER, AND THE SNOHOMISH RIVER.

Water Use: Fish Propagation and Habitat (including the other aquatic and semi-aquatic life)

(Marine, estuarial, and fresh water as indicated.)

1. Organisms of the Coliform Group

(MPN or equivalent MF, using a representative number of samples where associated with fecal sources.)

Marine and estuary

Not to exceed limits specified in the National Shellfish Sanitation Program Manual of Operations, USPHS.

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Fresh water

Consideration of the fishermen is required. Recommend the same parameters as for bathing, swimming, and recreational uses of water. (Average less than 240 per 100 ml and not exceed this in more than 20% of samples.)

2. Dissolved Oxygen (mg/l)

Marine and estuary

Greater than six (6) mg/l.

Fresh water

Greater than 95% saturation with a minimum value of 7 mg/l. These values to be present at the diurnal and seasonal lows and when temperatures exceed 60 F (15.6 C).

3. pH

Marine and estuary

Hydrogen ion concentration expressed as pH. Between pH range of 7.8 and 8.5. Sudden changes of pH units of 0.5 or more should not occur as a result of man-made activities.

Fresh water

Hydrogen ion concentration expressed as pH. Between pH range of 6.5 and 8.5 unless historical natural values (conditions) lie outside that range. Sudden changes of pH values of 0.5 or more should not occur as a result of man-made activities.

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4. Turbidity

Marine and estuary

Turbidity for marine and estuarial waters, upper 10 meters (32.5 ft) to be based upon vertical extinction coefficient. Standards should be coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. A Secchi disc may be used for determination of vertical extinction coefficient using the ratio of 1.7 divided by Secchi disc reading (Secchi disc reading in meters for a 30 centimeter diameter white disc) for blue light as developed by Poole and Atkins, 1929, Journal Marine Biological Association, United Kingdom (16).

No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above references.

In the deeper waters (mid-depth and bottom samples) Jackson Turbidity Units should be less than 25 attributable to materials resulting from man-made activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

Fresh water

Jackson Turbidity Units (JTU) of less than

5 attributable to materials in fresh-water streams resulting from man-caused activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

5. Temperature F(C)

Marine and estuary

Water temperature should not be altered more than 5% in the range between 40 F (4.4 C) and 60 F (15.6 C).

Fresh water

Fresh water - If natural temperatures of the receiving waters are in excess of 60 F (15.6 C), no additive or use that will cause a higher temperature should be permitted. The optimal temperature range of fresh-water areas for salmonids is 45 F (7.2 C) to 60 F (15.6 C).

6. Dissolved Inorganic Substances

Marine, estuary and fresh water

Inorganic materials especially the ionic forms of heavy metals are deleterious to fish and other aquatic organisms. None should be discharged to the receiving waters that will create acute or chronic toxicity or significant ecological change. Reference: p: 423-426

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT E "The Physiology of Fishes": and Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd. Control of abnormal enrichment from phosphates, etc.

7. Residues (fats, oils, grease, and floating solids, sludge deposits)

Marine, estuary and fresh water

Oils, tars, grease, animal fats: none allowable. It should be a consistent policy to eliminate oils, floating solids, suspended solids, sludge, and sediment before they can enter the receiving water. Includes earth or other materials from construction projects.

8. Sediment

Marine, estuary and fresh water

No deposition which adversely affects fish or shellfish propagation, growth, and habitat. Conditions ascribed to nature should be controlled wherever possible. Includes earth or other construction materials from road, dike, or culvert projects. Also debris from construction or operation of dams and reservoirs. Absence of sludge deposits.

9. Toxic or Other Deleterious Substances (pesticides, phenolics, and related organic and inorganic materials)

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Marine, estuary and fresh water

None allowed from domestic, industry, agriculture or mining, including earth or other construction materials from road, bridge, dike, or culvert projects that will produce stress on aquatic organisms or result in a significant ecological change. Use of pesticides by any governmental or private entity to be stringently controlled. In no case shall pesticides or other material be allowed which could limit or prohibit the use of fish or shellfish for commercial or personal use. Absence of concrete leachings, etc.

Suggested reference: Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd.

10. Color

Marine estuary

To be based upon effective light penetration into the water as expressed by vertical extinction coefficient. Standards should be the coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above reference.

Fresh water

Fresh-water streams. The Platinum - Cobalt method is acceptable for determination of the true color, which should be less than 50 color units.

11. Radioactivity

Marine, estuary and freshwater

Current USPHS Drinking Water Standards except where concentration factors of aquatic flora and fauna exceed PHS reduction factors; then MPC of radioisotopes shall be reduced below acute or chronic problem levels. Conformance with U. S. Pure Food and Drug Administration standards.

12. Aesthetic Considerations (wastes offensive to the senses of sight, taste, smell, or touch)

Marine, estuary and fresh water

Anything that is offensive to these senses should not be added to the receiving waters. Such wastes are nuisances to fishermen, although they may be innoxious to fish, shellfish or other aquatic organisms.

13. Dissolved Organics (settleable solids, sewage)

Marine, estuary and fresh water

Secondary treatment of sewage wastes is recommended. No excess nutrients that cause biological imbalance, slime, or other nuisance aquatic growth.

Non-biodegradable materials should not be added to the receiving waters. Free chlorine to be at concentration equivalents below 0.05 mg/l of available chlorine (receiving water). Absence of foam.

14. Garbage, Agricultural and Other Similar Wastes

Marine, estuary and fresh water

The waters of the State of Washington should not be used for the disposal of garbage, agricultural or other similar wastes. No garbage or similar wastes, or drainage from land disposal areas should enter the receiving waters.

15. Water Control Structures

Marine and estuary

No structure or alteration of flow should be allowed that will modify natural conditions by more than 5% of their maximum value in respect to water temperatures, salinity, tide range, and tidal velocity. Changes beyond this magnitude may be considered only if it can be conclusively shown that the proposed change will result in enhancement of water quality and will not cause an ecological upset.

Fresh water

Restrictions as to dams, ditches, and other uses of waters and waterways shall be as set forth in Titles 43 and 75, Revised Code of Washington, Chapter 75.20, 1966 and such other chapters of the Fisheries Code applicable.

Table 15. PUGET SOUND WATERS NORTH OF PORT TOWNSEND AND MUKILTEO, INCLUDING THE SUMAS RIVER, NOOKSACK RIVER, SKAGIT RIVER, STILLAGUAMISH RIVER, AND THE SNOHOMISH RIVER.

Water Use: Shellfish Growth and Propagation

(Marine and estuarial waters.)

1. Organisms of the Coliform Group

(MPN or equivalent MF, using a representative number of samples where associated with fecal sources.)

Not to exceed limits specified in the National Shellfish Sanitation Program Manual of Operations, USPHS.

2. Dissolved Oxygen (mg/l)

Greater than six (6) mg/l in the larval stage. Greater than five (5) mg/l in the adult stage.

3. pH

Hydrogen ion concentration expressed as pH. Between pH range of 7.8 and 8.5. Sudden changes of pH units of 0.5 or more should not occur as a result of man-made activities.

4. Turbidity

Turbidity for marine and estuarial waters, upper 10 meters (32.5 ft) to be based upon vertical extinction coefficient. Standards should be coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson and Fleming, 1946. A Secchi disc may be used for determination of vertical extinction coefficient using the ratio of 1.7 divided by Secchi disc reading (Secchi disc reading in meters for a 30 centimeter diameter white disc) for blue light as developed by Poole and Atkins, 1929, Journal Marine Biological Association, United Kingdom (16).

No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above references.

In the deeper waters (mid-depth and bottom samples) Jackson Turbidity Units should be less than 25 attributable to materials resulting from man-made activities.

Dredging operations should be planned to take into account the seasonal cycles of flow and turbidity so as not to exceed the proposed standards.

5. Temperature F(C)

Water temperature should not be altered more than 5% in the range between 40 F (4.4 C) and 60 F (15.6). When natural conditions are above 68 F (20 C) man-made activity should not result in discharge raising the average water temperature in the dilution area more than 1%.

6. Dissolved Inorganic Substances

Inorganic materials especially the ionic forms of heavy metals are deleterious to fish and other aquatic organisms. None should be discharged to the receiving waters that will create acute or chronic toxicity or significant ecological change. Reference: p: 423-426 "The Physiology of Fishes": and Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd. Control of abnormal enrichment from phosphates, etc.

7. Residues (fats, oils, grease, and floating solids, sludge deposits)

Oils, tars, grease, animal fats: none allowable. It should be a consistent policy to eliminate oils, floating solids, suspended solids, sludge, and sediment before they can enter the receiving waters. Includes earth or other materials from construction projects.

8. Sediment

No deposition which adversely affects fish or shellfish propagation, growth, and habitat. Conditions ascribed to nature should be controlled wherever possible.

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Includes earth or other construction materials from road, dike, or culvert projects. Also debris from construction or operation of dams and reservoirs. Absence of sludge deposits.

9. Toxic or Other Deleterious Substances (pesticides, phenolics, and related organic and inorganic materials)

None allowed from domestic, industry, agriculture, or mining, including earth or other construction materials from road, bridge, dike, or culvert projects that will produce stress on aquatic organisms or result in a significant ecological change. Use of pesticides by any governmental or private entity to be stringently controlled. In no case shall pesticides or other material be allowed which could limit or prohibit the use of fish or shellfish for commercial or personal use. Absence of concrete leachings, etc.

Suggested reference: Water Quality Criteria, 2nd Ed., Pub. 3A, 1963 Calif. Water Qual. Control Bd.

10. Color

To be based upon effective light penetration into the water as expressed by vertical extinction coefficient. Standards should be the coastal maximums as listed in Table 22, p. 84 and by Figure 20, p. 85, The Oceans, Sverdrup, Johnson, and Fleming, 1946. No material should be added to the water that causes the extinction coefficient to become larger than the standard values as given in the above reference.

11. Radioactivity

Current USPHS Drinking Water Standards except where concentration factors of aquatic flora and fauna exceed PHS reduction factors; then MPC of radioisotopes shall be reduced below acute or chronic problem levels. Conformance with U. S. Pure Food and Drug Administration standards.

12. Aesthetic Considerations (wastes offensive to the senses of sight, taste, smell or touch)

Anything that is offensive to these senses should not be added to the receiving waters. Such wastes are nuisances to fishermen, although they may be innoxious to fish, shellfish, or other aquatic organisms.

13. Dissolved Organics (settleable solids, sewage)

Secondary treatment of sewage wastes is recommended. No excess nutrients that cause biological imbalance, slime, or other nuisance aquatic growth. Non-biodegradable materials should not be added to the receiving waters. Free chlorine to be at concentration equivalents below 0.05 mg/l of available chlorine (receiving water). Absence of foam.

14. Garbage, Agricultural and Other Similar Wastes

The waters of the State of Washington should not be used for the disposal of garbage, agricultural, or other similar wastes. No garbage or similar wastes, or drainage from land disposal areas should enter the receiving waters.

15. Water Control Structures

No structure or alteration of flow should be allowed that will modify natural conditions by more than 5% of their maximum value in respect to water temperatures, salinity, tide range, and tidal velocity. Changes beyond this magnitude may be considered only if it can be conclusively shown that the proposed change will result in enhancement of water quality and will not cause an ecological upset.

Restrictions as to dams, ditches, and other uses of waters and waterways shall be as set forth in Titles 43 and 75, Revised Code of Washington, Chapter 75.20, 1966 and such other chapters of the Fisheries Code applicable.

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT F

State of Washington Department of Fisheries, Room 115, General Administration Building, Research Division, Olympia, Washington

Memorandum to Administration, from Research, date January 19, 1967, Memo No. 2011

Subject: RECOMMENDATIONS FOR THE 1967 PUGET SOUND SALMON FISHERY.

This memorandum will cover proposals for the 1967 Puget Sound salmon season. Fishing in Areas 1 and 4 will be under IPSFC controls from June 25 through September 30, and in Area 2 from June 25 through September 16. Control during all other times and in all other areas will be under guidance of the Washington Department of Fisheries.

Following are brief summaries of expectations for 1967 and proposals for management of these runs of fish.

Sockeye

Fraser River: The estimate from the IPSFC is for a run which will equal or exceed the 1963 parent run of 3,800,000 fish; also, that the 1967 catch will equal or exceed the 1966 catch of 1,340,000 sockeye for each country. This run is considered substantial for the cycle year in contrast to the last three cycle years. The four primary races comprising the 1967 run will be Chilko, which by itself may exceed 1,000,000 sockeye; a substantial sub-dominant

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Adams race; and sub-dominant Stellako and Birkenhead races.

The 1967 Washington fleet size should approximate 250 purse seines, 550 to 600 gill nets, and 65 reef nets. Regulation proposals from IPSFC call for 2 to 3 days per week fishing. The approximate timing of the 1967 sockeye cycle can be estimated from Figure 1 where the 1959 and 1963 catches are plotted for the San Juan Islands. Also shown is the expected timing of the pink salmon run through the San Juan Islands.

(See figure 1, which follows:)

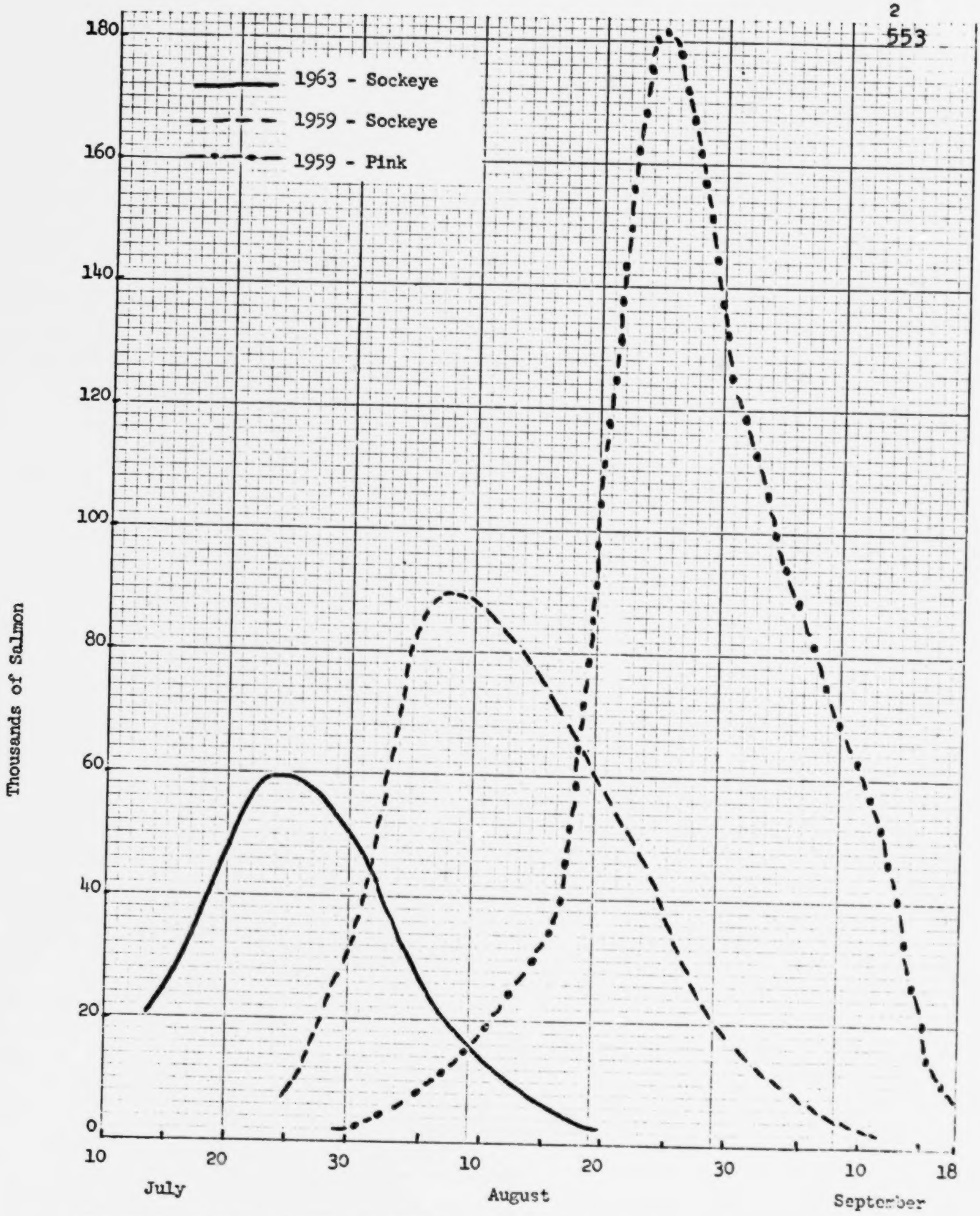

Figure 1. Timing of 1959 and 1963 sockeye run and 1959 pink salmon run in the San Juan Island area.

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Lake Washington: Based upon the 1962 and 1963 escapements, the Lake Washington sockeye run is not expected to be large enough in 1967 to justify a fishing season; and therefore, no commercial fishery on this stock is recommended in 1967. It is recommended that two gill net boats be chartered to conduct a test fishery in the area between Ballard and Edmonds.

Pinks

In Areas 1, 2, and 4, the IPSFC regulation proposals call for 4 days per week fishing from August 13 through September 30. Control will be relinquished on September 16 in Area 2 and on October 1 in Areas 1 and 4.

The IPSFC expects the 1967 Fraser River pink salmon run, by itself, to be better than any year since 1957, and possibly since 1955. The convention area catch is expected to be 5 to 7 million fish total, or 2½ to 3½ million pink salmon for the fishermen of each country.

The pink run to the Nooksack River is not expected to be large enough in 1967 to allow a harvest and the area should remain closed to salmon fishing with pink salmon nets. The 1965 escapements amounted to only 12,500 pink salmon.

The Skagit River pink run is expected to be near the poor 1965 run, and it is proposed that the pink salmon season be set at 3 days per week from August 19 through September 16. Should this prove to be too much fishing time when the run develops, it may be reduced by emergency orders at the time. Fishing on West Beach is set at 4 days per week during the pink salmon run, and if the Sakgit run develops as expected, the IPSFC should be requested to reduce fishing time in this area to match Skagit Bay. The delay of one week in opening of pink salmon fishing is to increase the chinook harvest while giving additional protection to the pink salmon.

Preseason predictions based upon escapements and estuarial estimates of survival indicate runs to the Stillaguamish and Snohomish systems about equal to those of 1965, which were only of moderate size. With this in mind, it is proposed that the season in Area 5 be set at three days per week from August 13 through September 16.

Indications are that the pink runs to the Puyallup River and the rivers of Hood Canal will be quite strong in 1967, and it is recommended that Areas 4A and 6 be opened 4 days per week from August 13 through September 2, and 3 days per week from September 3 through 16. Tagging at Bush Point in Admiralty Inlet has revealed that after September 1, the Stillaguamish and Snohomish

River pink salmon runs are dominant in Admiralty Inlet and four days fishing per week is not justified here if the Area 5 fishery remains at 3 days per week. Purse seines would be allowed in Areas 4 and 4A from August 1 through 31. Should a large gill net fishery develop at the entrance to Hood Canal, it would be advisable to open the Hood Canal salmon preserve to the same line used during the chum salmon season.

During the past 2 cycles, the Dungeness River pink run has been quite large, especially in 1963. Preseason predictions indicate a possible large run again in 1967, and it is proposed that a 2 days per week season be set from August 3 through 31 for purse seines only in the area shown in Figure 2. During the pink salmon runs, the Department will maintain a counting station at the first riffle above tidal influence. The count at this station will be used to help determine the actual amount of fishing to be allowed. It is proposed that the open periods be on Thursday and Friday to encourage fishermen to leave a very lucrative sockeye and pink salmon fishery in other areas, and try out the Dungeness River run. The proposal is to open this area (Figure 2) for purse seines only as the area is very small, and it will be necessary to monitor the fishery very closely and ask for cessation

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of fishing if it appears that too many fish will be taken. With purse seines only, we would "request" an immediate cessation of fishing if needed. With a gill net fishery also, it would not be possible to accomplish such a closure on short notice. Because of the small size of the area to be opened, gill nets would be likely to drift into closed areas, making close patrolling necessary.

(See figure 2, which follows:)

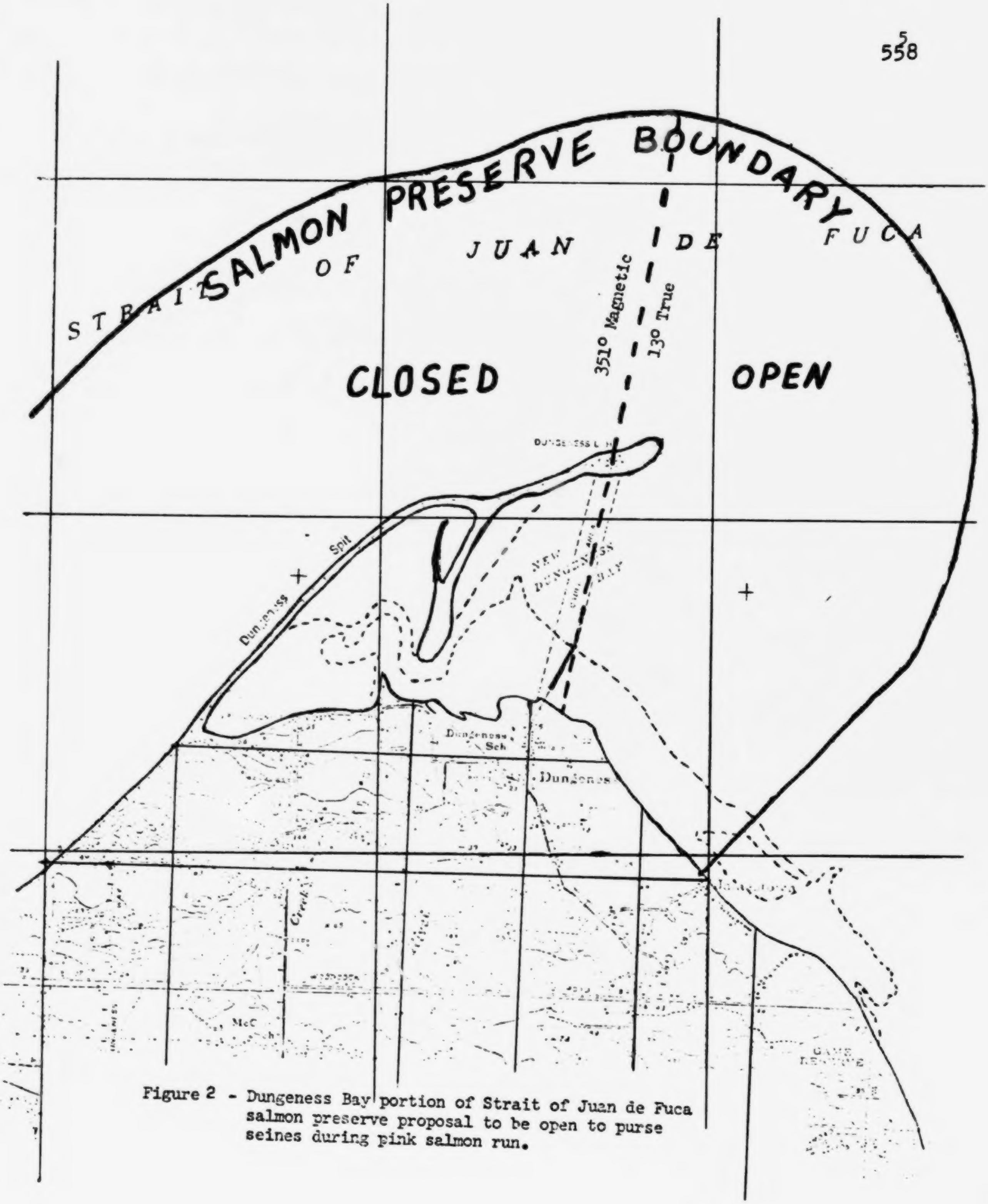

Figure 2 - Dungeness Bay portion of Strait of Juan de Fuca salmon preserve proposal to be open to purse seines during pink salmon run.

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Coho

Several estimates of the expected 1967 coho catch have been derived from correlations with Puget Sound streamflow data. One method of estimating the total Puget Sound net catch is based upon the total "cubic feet run off per square mile of drainage area" (cfsm) for Washington streams during the calendar year when young coho are rearing in fresh water. This is the method we have been using for the past several years to obtain our estimates, but several drawbacks to this method have become apparent. First, a high winter or spring flow can mask seriously low summer flows; second, no consideration is given to increasing hatchery production; third, the amount of fishing time allowed varies greatly and the extremes in catches are exaggerated.

A second method is presently under study which utilizes the "cfsm" for the months of June through September, when summer flows are at the lowest levels. Preliminary results on this method show promise and indicate the possibility of a poor coho catch in Puget Sound this year of around 300,000 fish. The first method, on the other hand, indicates a catch of 374,000. It is expected that the actual catch will lie somewhere between these two figures or about 350,000, a catch which would be about average for the period 1935-1960, but below the catch during the past 3 years.

Based upon the predicted catch, however, it is recommended that the basic coho season be 4 days per week after the pink salmon season ends on September 16, and any adjustments made as needed next fall. Should the IPSFC relinquish control of convention waters prior to the dates scheduled, the amount of allowable fishing time should be decided at the time, depending upon the strength of the developing coho runs.

Chinook

The catch of chinook from Puget Sound as a whole is expected to be better than in 1966, or approximately 100,000 fish. The runs to Puget Sound hatchery streams are expected to be better than in 1966, as is the Skagit River run. With reduced fishing time expected during the sockeye salmon run, there is apt to be a subsequent reduction in the incidental catch of chinook in all of Area 1, prior to August 13.

Skagit Bay

The Skagit River chinook run in 1966 was about 5,000 fish below the preseason estimate made last spring. The catch was 18,000 while the escapement was estimated at 15,000, about as desired. The Skagit River chinook correlation (Figure 3) has been reworked by Steve Mathews and indicates an expected run of 37,000 fish in 1967. This would permit a catch of 22,000 chinook while allowing an escapement of 15,000 chinook.

The chinook run to the Skagit River has been shifting in time during the past few years from a peak near August 1 to a peak near August 10. This shift is shown in Figure 4, where average daily catches are plotted for the years 1951 through 1960 and compared with the averages for the years 1961 through 1966. The 1966 catches are shown in Figure 5 and the shift mentioned is quite obvious. It is our belief, based upon the timing of the Samish chinook run, that this shift in time is due to increased production of fall chinook from the Skagit hatchery. It can be expected that in 1967, August catches will be higher than in 1966 due to an increased hatchery plant of 1963 brook chinook salmon.

Catches in 1966 did not exceed the averages shown in Figure 4 prior to late July, indicating a very poor June and July run. Furthermore, a check of the age composition of the chinook catch showed a large number of 5's and less than 4% - 3's. During the two previous years, the percentage of 3's was 10-11%. We believe that the June-July segment of the chinook run in 1967 will again be below

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average and are, therefore, proposing that the Skagit chinook season not open until May 21 and that it be held to 3 days per week until July 29. From July 30 to August 19, it is proposed to fish 5 days per week (3 weeks) to increase the harvest on what is expected to be the major segment of the run in 1967. After August 19, it is proposed to reduce fishing time to 3 days per week and permit the pink salmon fishery to begin. It is expected that these changes, although resulting in a net loss of 7 days from the usual season, will result in a higher catch in 1967 than in 1966.

(See figures 3, 4 and 5, which follow:)

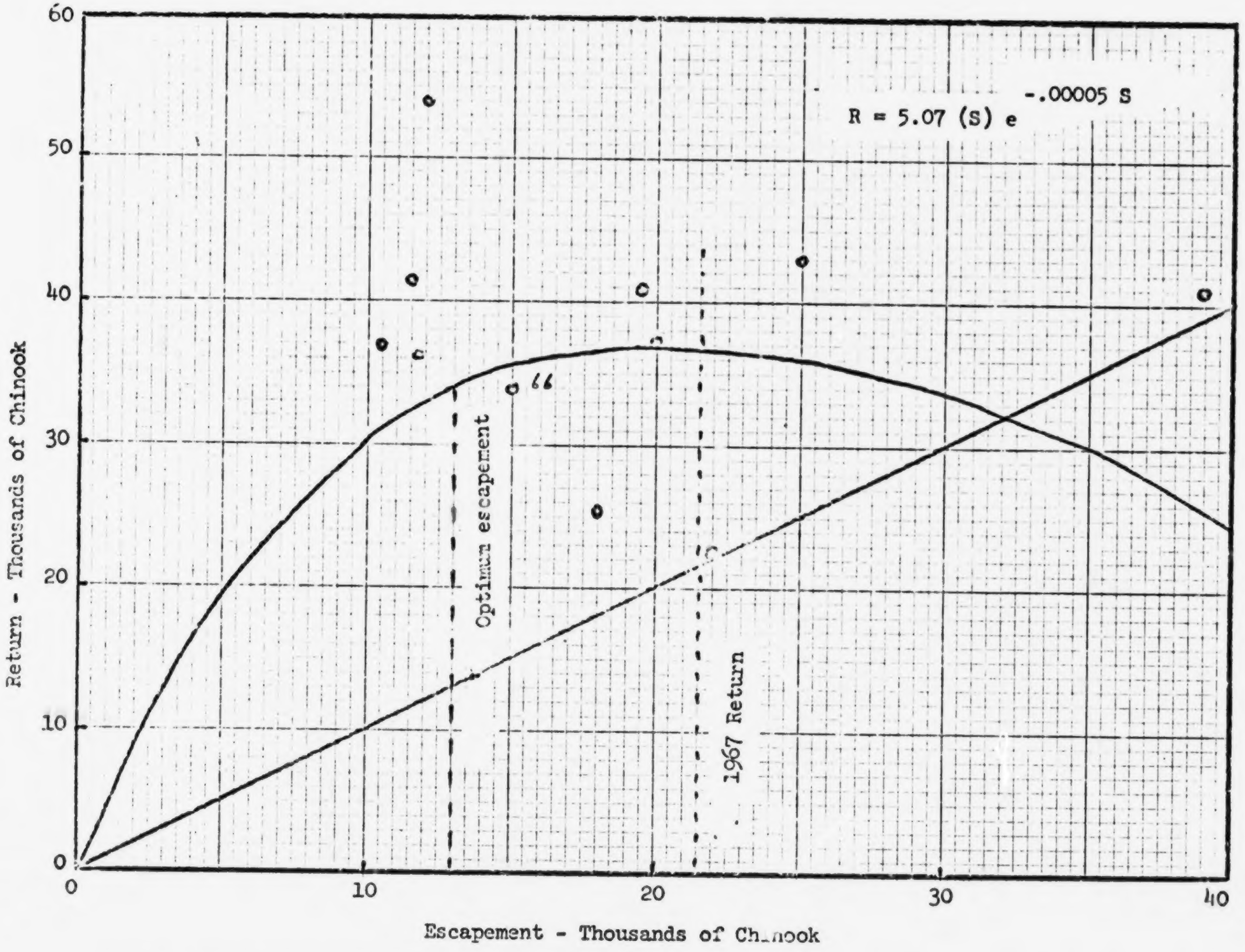

Figure 3. Relationship of Skagit River chinook - escapement to return.

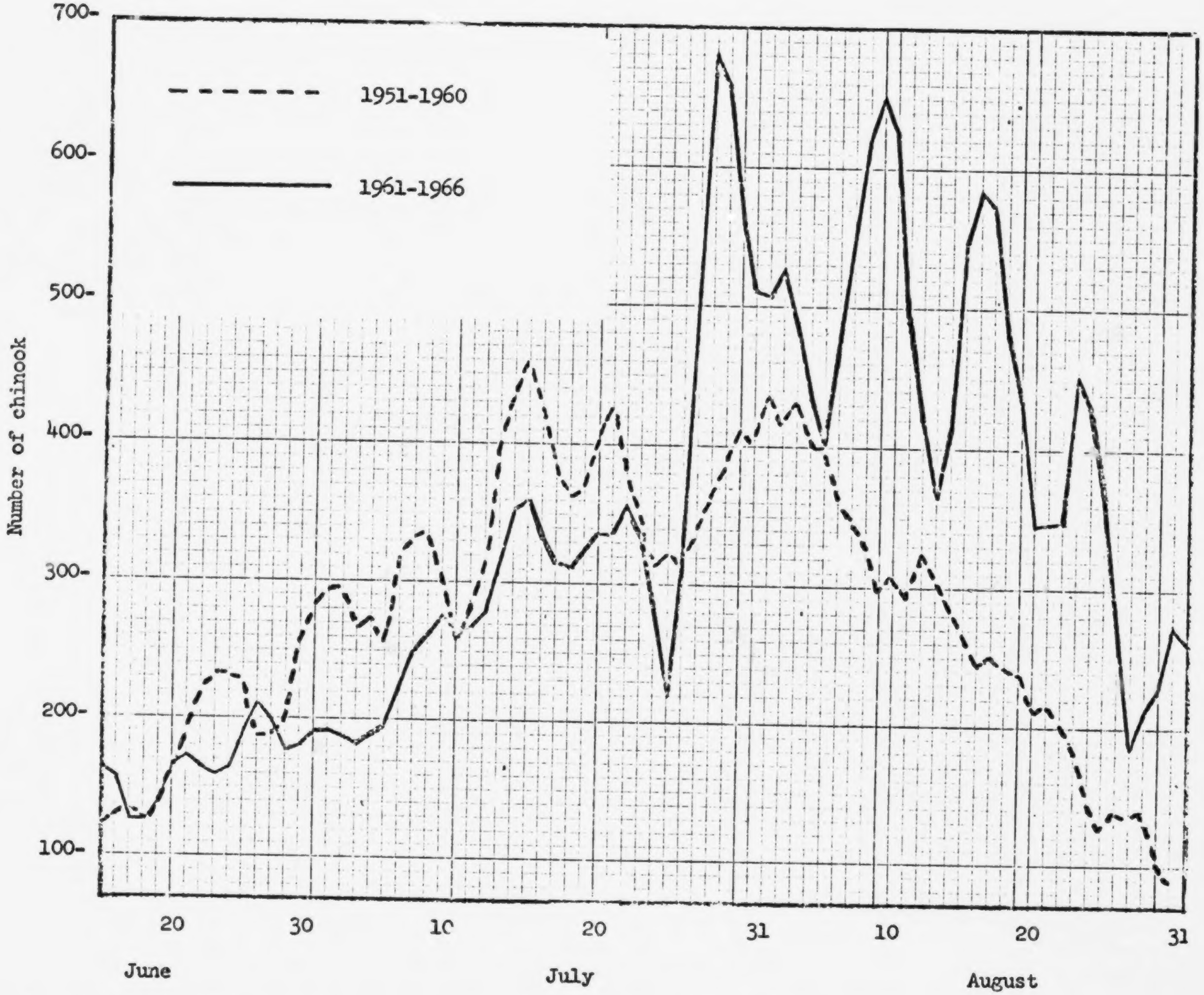

Figure 4. Timing of Skagit Bay chinook catches (all gear), 1951-1960 and 1961-1966. Three day moving averages. Minor Indian catches omitted for 1951-1960. Open period catches only for 1961-1966.

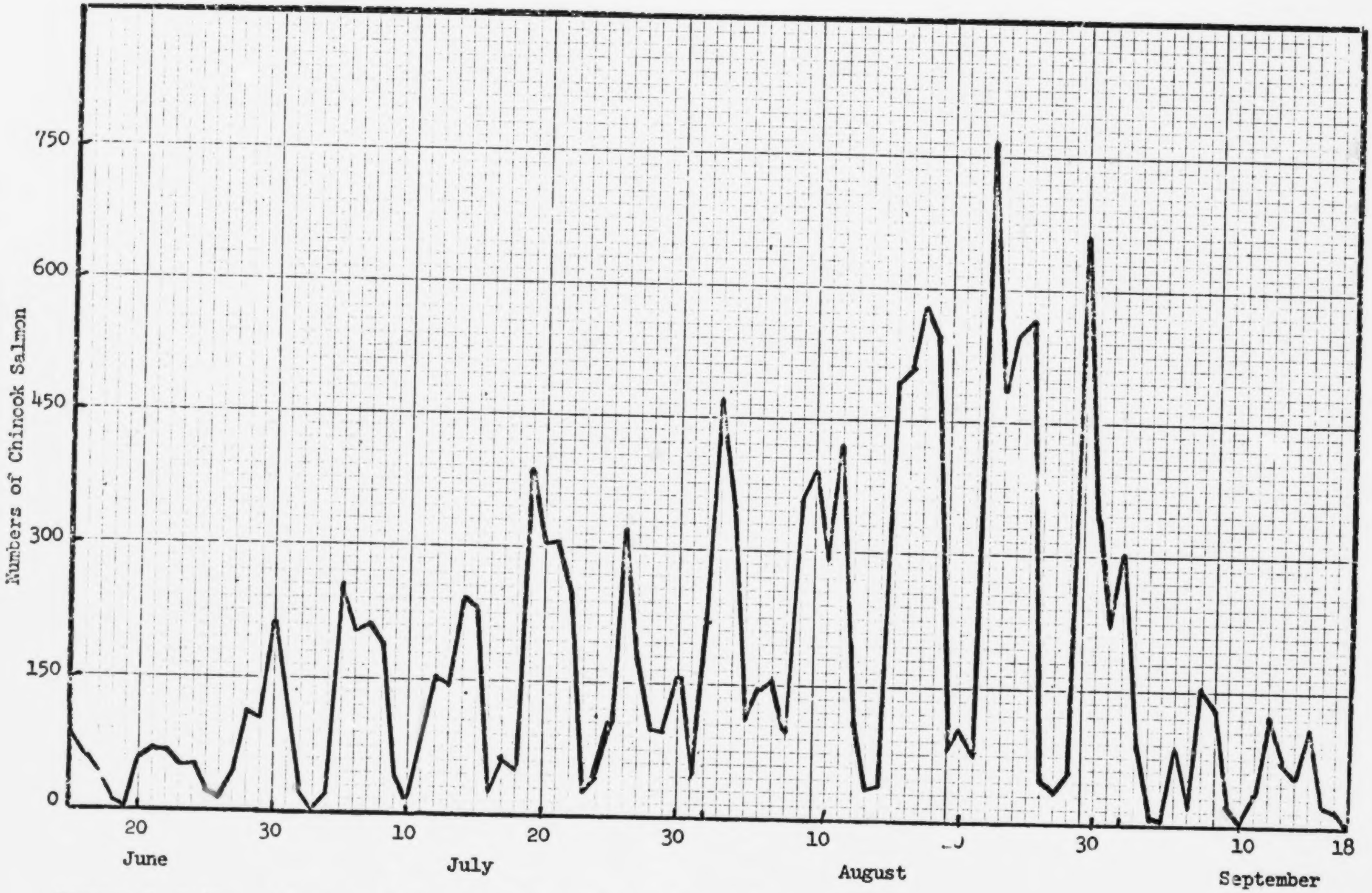

Figure 5. Daily catches of chinook salmon - Skagit Bay - All Gear - 1966.

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Bellingham Bay

The Nooksack River and Samish River runs of chinook still appear to be responding quite well to hatchery plants, with the 1967 run expected to be 3-6,000 fish larger than the 1966 run. This should result in a catch of about 26,000 chinook or about 4,000 above the record catch of 22,000 attained in 1966.

From the relationship derived from hatchery plants and returns for the Nooksack - Samish systems (Figure 6), it appears that the run of chinook in this area during August and September is being sustained by hatchery plants. Timing of the 1966 catch from Bellingham and Samish Bays, as illustrated in Figure 7, was normal.

Since eggs for the Puget Sound hatchery system are supplied on a pool basis and no chinook eggs will be taken at Samish in 1967, there is little liklihood that future production will be seriously harmed by increased fishing pressure. The original hatchery stock for this area came from the Green River Hatchery, and the hatcheries at the Samish and Nooksack Rivers will be supplied from this source in 1967, as they were in 1965 and 1966.

For these reasons, it is proposed that Bellingham Bay (Areas 3 and 7) be opened 5 days per week from July 30 to September 9, and 4 days per week thereafter. This would permit the largest harvest when the fish were bright and bringing their best price (30 to 45¢ per pound). It is also recommended that the Samish Bay Salmon Preserve opened to commercial net fishing in 1966 be opened even further in 1967, as shown in Figure 8. This special opening would extend from July 30 until September 9. The 1966 Samish River escapement of approximately 3,000 fall chinook exceeded our preseason goal of a minimum of 1,000 spawners. No chinook eggs will be taken at this station in 1967.

Inner-Puget Sound

It is proposed that Port Susan - Port Gardner (Area 5), Admiralty Inlet (Area 4A), and the waters south to Tacoma (Area 6) be opened to gill nets containing mesh of at least 8 inches for 5 days per week, from July 30 to August 12. In 1966, a five day per week fishery in these areas, during the last two weeks in July, yielded only 22 chinook to the non-Indian gill nets. We, therefore, have recommended that these areas not open prior to July 30 in 1967.

(See figures 6, 7 and 8, which follow:)

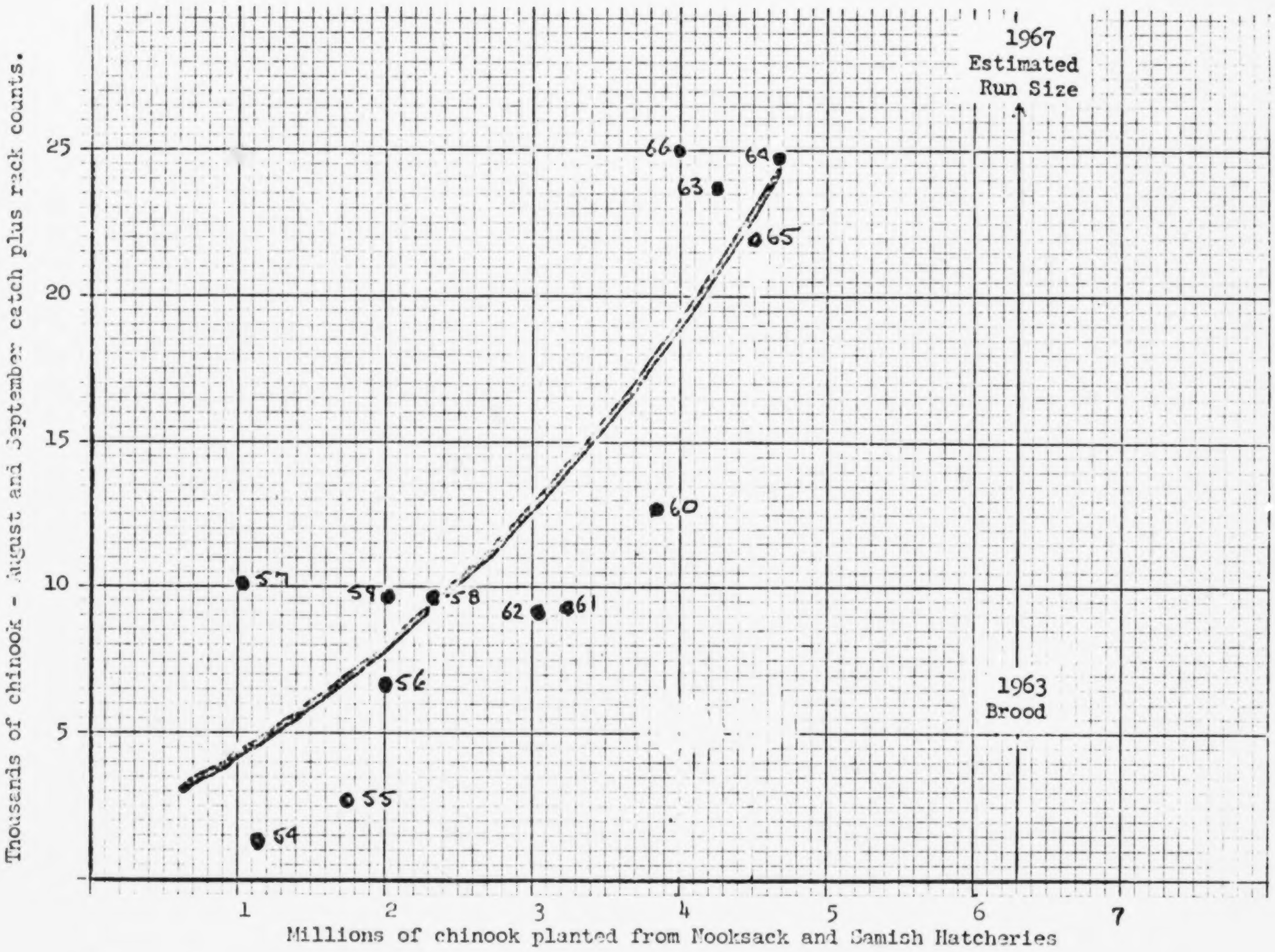

Figure 6. Correlation of August and September Bellingham Bay chinook catch plus hatchery rack count with hatchery chinook plant 4 years previously.

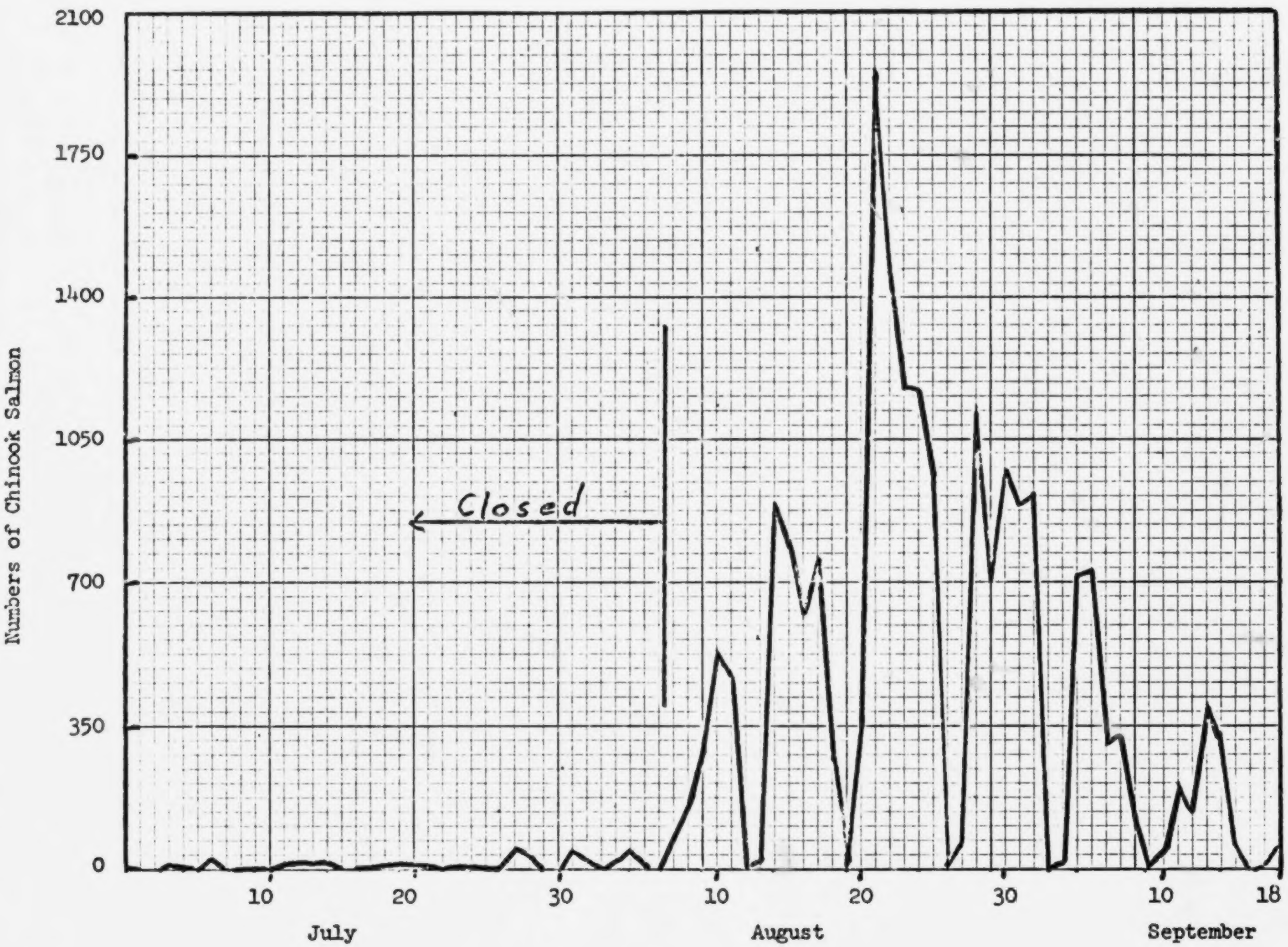

Figure 7. Daily catches of chinook salmon - Areas 3 and 7, All Gear - 1966.

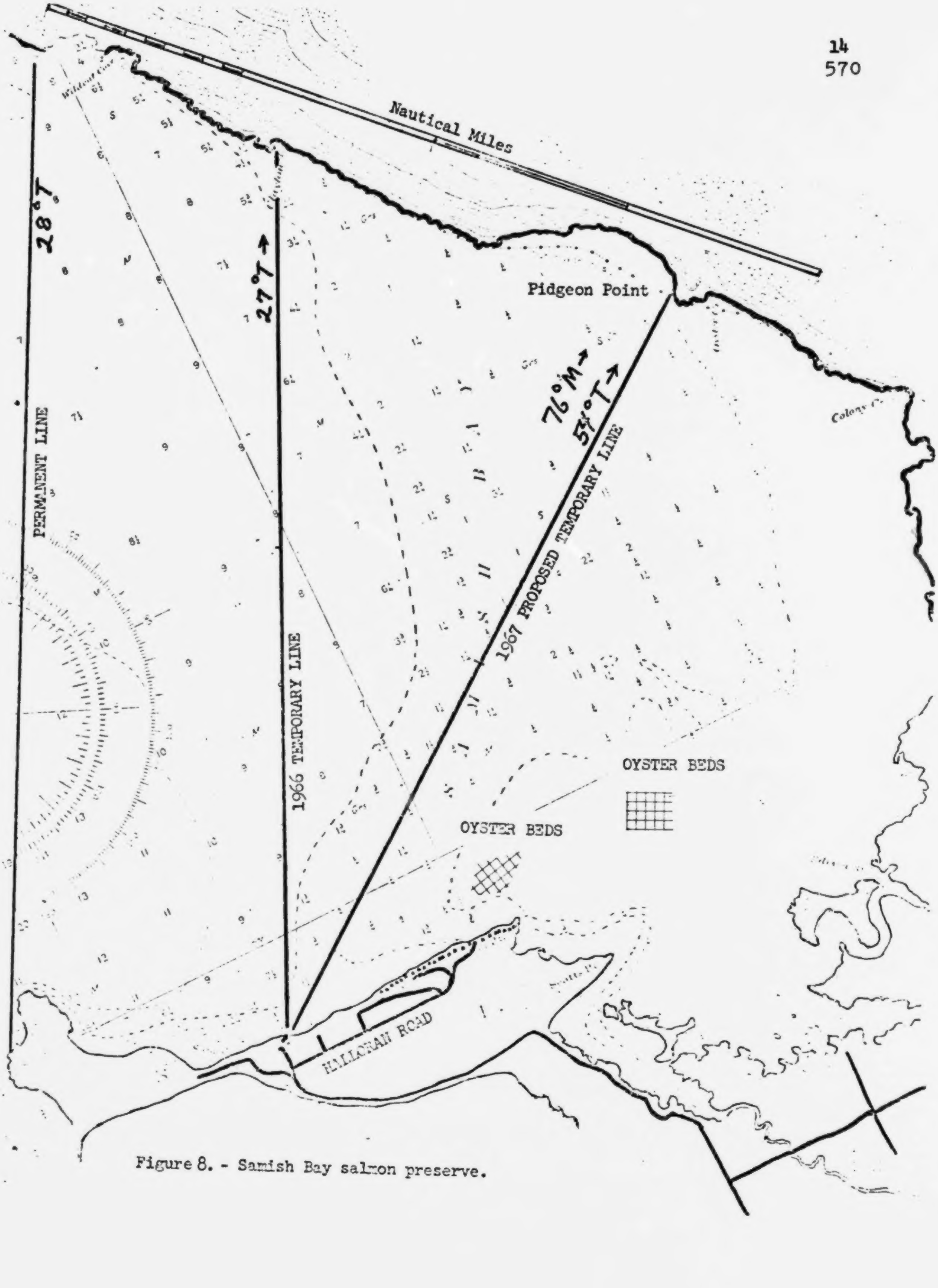

Figure 8. - Samish Bay salmon preserve.

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Northern Puget Sound

It is proposed that the early chinook fishery permitted in northern Puget Sound since 1964 be continued in 1967 with the following provisions:

1. Season to open May 21 and terminate June 24 (same as in 1966).

2. Season to be open 5 days per week (same as in 1966).

3. The southern boundary, prior to June 17, be at Lime Kiln Light and the south end of San Juan Channel and Lummi Rocks to Point Lawrence (same as in 1966).

4. It is proposed that this early chinook fishery be extended to all of Area 1 from June 18 through June 24 for 5 days (West Beach) (1 week less fishing time than in 1966).

During this early period fishery at Point Roberts, the U. S. fleet took 8,562 chinook of probable Fraser River origin, while the Canadian Fraser River gill net fishery landed 13,600 chinook. It appears that the 1967 run will be of the same general magnitude as in 1966.

The IPSFC has made provisions in their recommendations for a chinook fishery during the two week closure from June 25 through July 8. All nets used during this time would have to be 8" mesh or greater. The result of such a season would be elimination of purse seines and establishment of a gill net fishery on West Beach. With the proposed reduced fishing time in Skagit Bay, extra fishing time on West Beach would not be desirable, and it is recommended that this one week period remain closed.

Chum

At the present time, catch, age, escapement, hydraulic fry sampling, and marine surveys of juvenile abundance point to a continuance of the same general magnitude of runs as in 1965; that is, fairly poor runs in all areas except Hood Canal and South Sound, with the runs to these latter areas expected to be less than in 1966.

For the Everett area, the outlook for 3 and 4 year old chum is only fair at best, while in Skagit Bay 3 year old chum are expected to reflect the apparent good survival of the 1964 brood. The overall abundance of chum salmon in Skagit Bay, and Bellingham Bay, is expected to approximate the low 1966 level, with only enough chum present to meet needed escapements.

Closure of the eastern Puget Sound chum fisheries in 1966 resulted in much improved escapements to every river system involved. It appears at this time that the closures imposed in 1966 will be desirable for

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the next three years, at least.

Recommendations are similar to last year on chum salmon with 4 days per week in Area 6 and a small portion of Area 4A, and no fishing elsewhere.

It is proposed that all areas except the portions of Areas 4A and 6, lying southerly of a line from the southwest end of the Indian Island bridge to Liplip Point on Marrowstone Island to Double Bluff on Whidbey Island to the Point Wells Range Light, be closed to all fishing after October 20 (Figure 9). Secondly, that the remaining open area be closed on November 17. The October 20th closure is to protect chum runs to all eastern Puget Sound streams and the Fraser River, while the November 17th closure will minimize the steelhead catch and provide additional protection to southern Puget Sound chum runs. The 1966 catches in Areas 4, 4A and 6 are shown in Figure 10. As can be seen, the major portion of the chum catch in 1966 occurred prior to the proposed closure on November 17. Further information on numbers of fish landed and percentage of the total harvest normally taken after November 17, is presented in Table 1.

A summary of the proposed fishing time is given in Table 2 and is compared by area and gear for all years since 1958.

(See figures 9 and 10 and tables 1 and 2, which follow:)

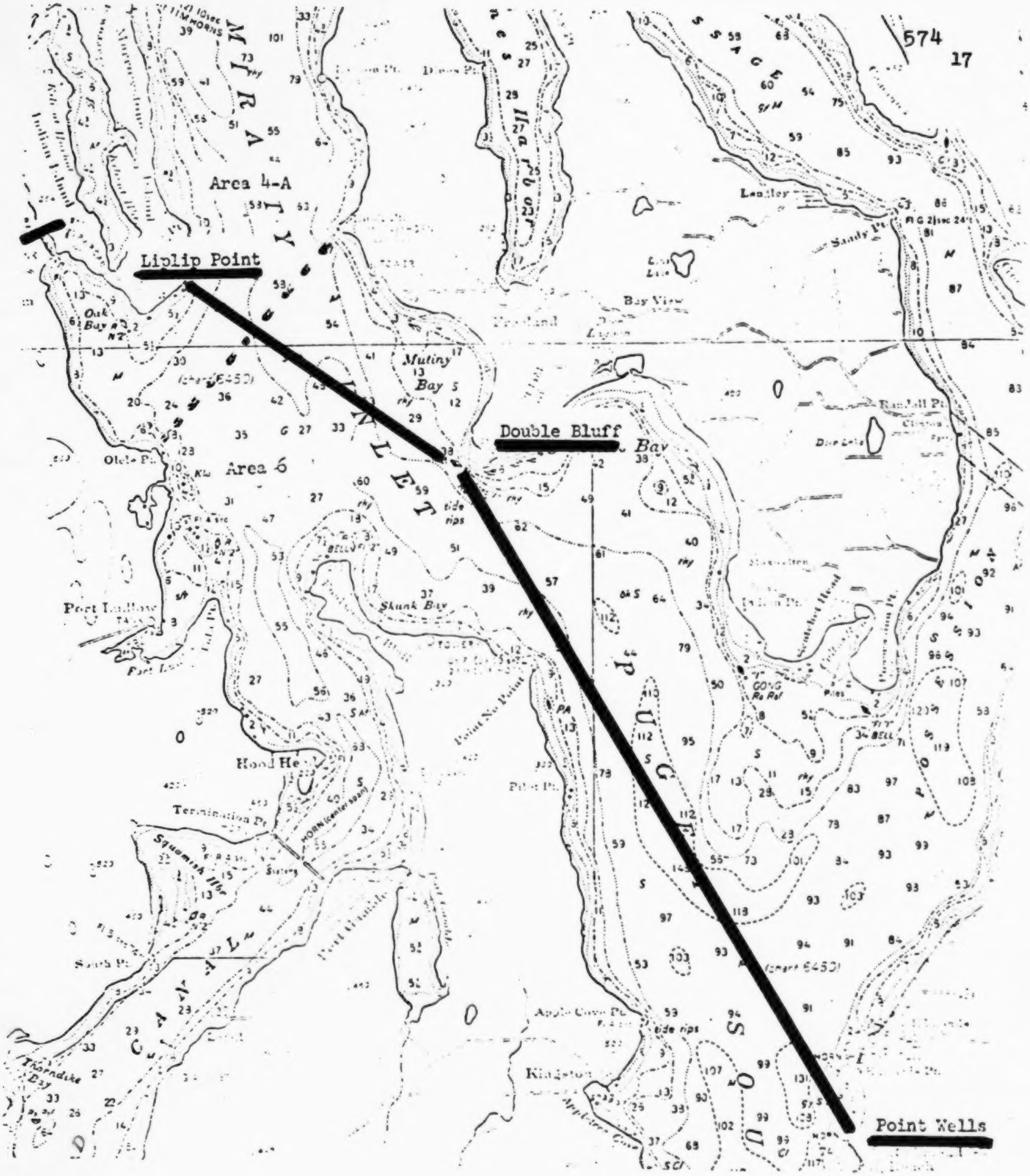

Figure 9. - Proposed Admiralty Inlet closure line during chum season.

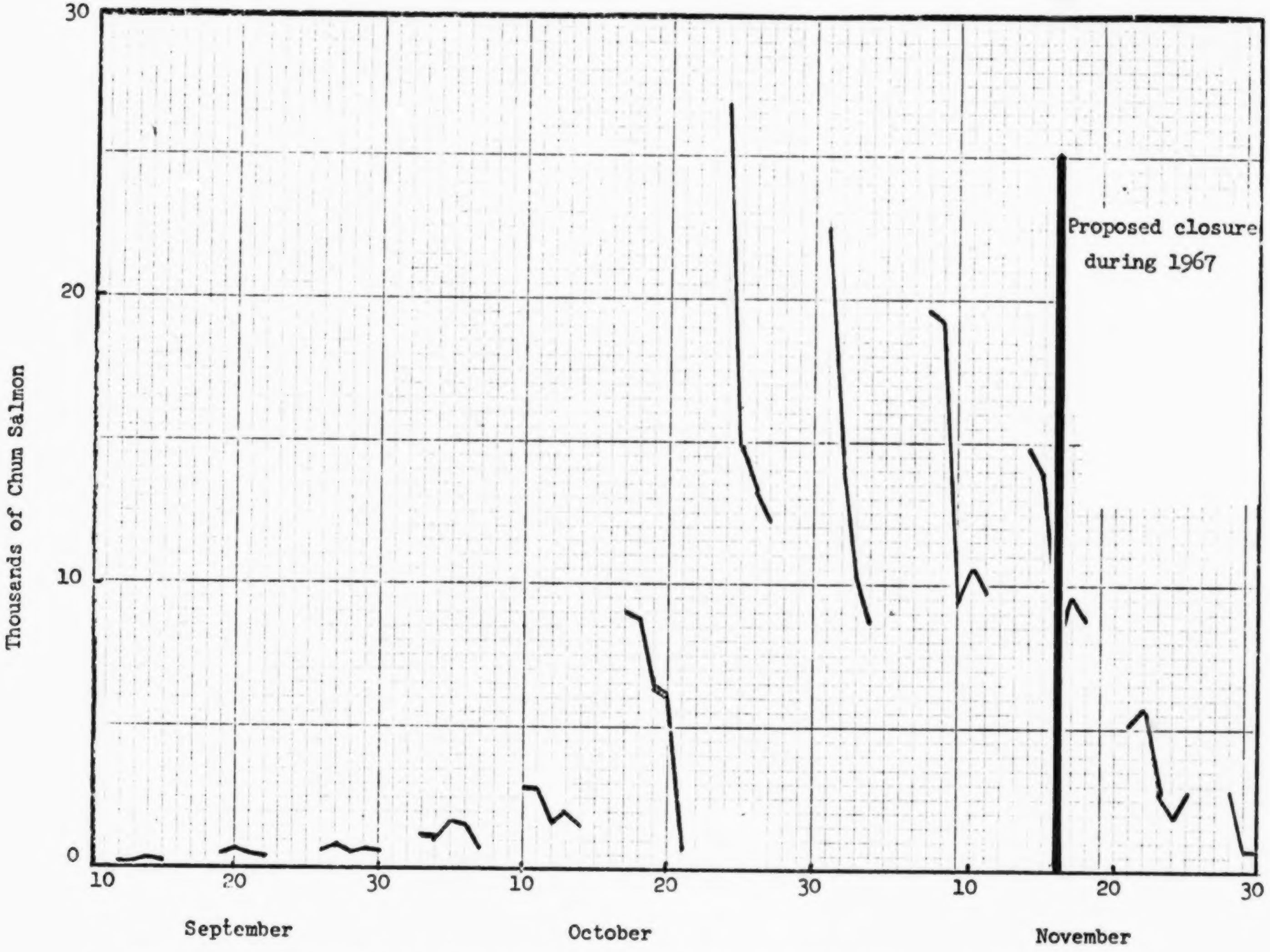

Figure 10. Daily catches of chum salmon - Areas 4, 4A, and 6 - All Gear - 1966.

Table 1. Number and percent of chum salmon caught after November 17, 1963-1966.[1]

	AREA											
Year	Hood Canal		Point No Point		Seattle		East Pass		West Pass		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1963	5,666	26.9	9,481	25.0	12,084	24.8	8,448	47.5	20,075	39.0	55,754	31.5
1964	7,049	12.7	429	1.6	5,328	17.5	2,792	25.9	1,917	9.2	17,515	12.2
1965	2,575	8.0	2,649	9.5	5,117	18.8	1,595	22.7	4,104	19.2	16,040	13.8
1966	5,694	7.9	6,844	7.6	7,080	8.5	2,337	16.3	12,229	22.8	34,184	10.9
Average 1963-1966	5,246	11.6	4,851	10.6	7,403	15.6	3,793	30.4	9,581	26.0	30,873	16.5

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[1] Percent of total chum catch.

Table 2. Annual number of gill-net nights and purse-seine days,* 1958 through 1966 with 1967 proposals.

Year	Gear	Areas							
		1	2	3 & 7	4	4A	5	6	8-9-10
1958	PS	87	62	24	24	24	24	24	24
	GN	82	58	100	100	100	100	100	92
1959	PS	70	68	28	24	24	24	24	24
	GN	69	67	86	80	80	80	80	78
1960	PS	98	41	28	16	16	16	16	16
	GN	73	41	68	68	68	68	68	64
1961	PS	53	45	27	27	27	27	27	27
	GN	60	44	87	72	75	75	75	85
1962	PS	52	45	21	21	21	21	21	21
	GN	77	46	85	52	80	80	80	80
1963	PS	78	42	12	33	33	12	32	12
	GN	78	42	83	53	75	67	74	84
1964	PS	99	43	20	31	31	21	31	20
	GN	99	43	81	92	66	79	92	88
1965	PS	82	38	14	42	43	14	34	14
	GN	82	38	61	75	86	61	90	76
1966	PS	59	51	16	16	16	16	38	16
	GN	81	50	51	64	68	68	91	89
1967 Proposed	PS	78	43	9	24	24	9	25	9
	GN	78	43	54	51	46	45	64	77

*Note: If part of area was open, it is shown as whole area open for computation of fishing time.

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The following seasons are proposed for Puget Sound in 1967.

Seasons by area: Dominant species and minimum mesh size shown by ( )( ).

Area 1 - (northern portion only) -

May 21 through June 17 - 5 days per week (chinook) (8" GN)

Area 1 -

June 18 through June 24 - 5 days (chinook) (8" GN)

June 25 through July 8 - Closed (sockeye)

July 9 through July 22 - 2 days per week (sockeye)(5" GN)

July 23 through August 12 - 3 days per week (sockeye) (5" GN)

August 13 through September 30 - 4 days per week (pinks - coho) (5" GN)

October 1 through October 21 - 4 days per week (coho-chum) (5¼" GN)

October 22 through November 30 - Closed (chum)

Area 2 (Strait of Juan de Fuca) -

June 25 through August 5 - Closed (sockeye)

August 6 through August 12 - 3 days (sockeye) (5" GN)

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August 13 through September 30 - 4 days per week (pink-coho)(5" GN)

October 1 through October 21 - 4 days per week (coho-chum)(5¼" GN)

October 22 through November 30 - Closed (chum)

Areas 3 and 7 - (Bellingham Bay) - Portion of Area 3 East of line from Carter Point on Lummi Island to Vendovi Island to Clark Point on Guemes Island.

June 11 through July 29 - Closed

July 30 through September 9 - 5 days per week (chinook)(8" GN) (Samish preserve to be open July 30 through September 9.)

September 10 through September 16 - 4 days (chinook)(8" GN)

September 17 through October 21 - 4 days per week (coho)(6" GN)

October 22 through November 30 - Closed (chum)

Area 4 - (Discovery Bay) -

June 11 through July 8 - Closed

July 9 through July 22 - 2 days per week (sockeye) (5¼" GN)

July 23 through August 12 - 3 days per week (sockeye)(5¼" GN)

August 13 through September 30 - 4 days

per week (pinks - coho)(5¼" GN)

October 1 through October 21 - 4 days per week (coho)(5¼" GN)

October 22 through November 30 - Closed (chum)

Area 4A - (Admiralty Inlet) -

June 11 through July 29 - Closed

July 30 through August 12 - 5 days per week (chinook)(8" GN)

August 13 through September 2 - 4 days per week (pinks)(5¼" GN)

September 3 through September 16 - 3 days per week (pinks)(5¼" GN)

September 17 through October 21 - 4 days per week (coho)(5¼" GN, 5" PS)

October 22 through November 30 - Closed (chum)

Area 6 (Hood Canal to South Sound) -

June 11 through July 29 - Closed

July 30 through August 12 - 5 days per week (chinook)(8" GN)

August 13 through September 2 - 4 days per week (pinks)(5¼" GN)

September 3 through September 16 - 3 days per week (pinks)(5¼" GN)

September 17 through November 18 - 4 days per week (coho-chum)(5¼" GN, 5" PS)(except - portion of Area 6 to be closed after October 21 (Figure 9).

November 19 through November 30 - Closed (chum)

Area 5 - (Port Susan - Port Gardner) -

June 11 through July 29 - Closed

July 30 through August 12 - 5 days per week (chinook)(8" GN)

August 13 through September 16 - 3 days per week (pinks)(5¼" GN)

September 17 through October 21 - 4 days per week (coho) (6" GN, 5" PS)

October 22 through November 30 - Closed (chum)

Areas 8, 9 and 10 - (Skagit) -

May 21 through July 29 - 3 days per week (chinook)(8" GN)

July 30 through August 19 - 5 days per week (chinook)(8" GN)

August 20 through September 16 - 3 days per week (pinks)(5¼" GN)

September 17 through October 21 - 4 days per week (coho)(6" GN, 5" PS in Area 10)

October 22 through November 30 - Closed (chum)

Point Roberts: Blowback area for protection of delaying pink salmon.

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September 3 to September 16 - Waters lying westerly of a straight line, projected true south from Lily Point, on Point Roberts, to the intersection with the international boundary line - Closed

September 17 to September 30 - Waters lying northerly and westerly of a straight line projected from Iwersen's dock on Point Roberts to Georgina Light at Active Pass - Closed

SPECIAL PROPOSALS

1. Under IPSFC rules, purse seines and reef nets fish first from July 9 to August 12; gill nets fish first from August 13 to September 30.

During the fall of 1964 and 1966, gill nets fished first, while in 1963 and 1965 purse seines fished first. It is, therefore, the purse seines turn to be first during the 1967 fall season. Propose to fish purse seines first after October 1.

2. It is recommended that the Samish preserve area west of a line from the northwest end of Halloran Road on Samish Island north to Pidgeon Point be opened for commercial fishing during all open fishing periods in Area 3 from July 30 to September 9, 1967 (Figure 7).

3. It is recommended that the following areas be closed from October 21 through November 30 to

increase chum salmon escapements where needed: Areas 1, 2, 3, 4, 5, 7, 8, 9, 10, and that portion of Areas 4A and 6 lying north and east of a line across the Indian Island Bridge and from Liplip Point on Marrowstone Island to Double Bluff on Whidbey Island; thence, to the Point Wells range light. All remaining waters would close on November 18.

4. It is proposed that the southern end of the Snohomish River preserve be moved 2,800 yards westward to the Point Elliot Light House at Mukilteo. (Proposal from John LaPlante - patrolman.)

5. Propose to set a fishing season for purse seines only in that portion of the Strait of Juan de Fuca salmon preserve lying easterly of a line projected northerly from the south shore of Dungesness Bay through the outer end of the abandoned dock and the Dungesness Spit Light House (Figure 2).

Proposed Openings for Special Purse Seine Season:

5:00 AM August 3 to 4:00 PM August 4 (2 days)
5:00 AM August 10 to 4:00 PM August 11 (2 days)
5:00 AM August 24 to 4:00 PM August 25 (2 days)
5:00 AM August 30 to 9:00 PM August 31 (2 days)

6. Propose to change the chinook mesh sizes

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for Puget Sound gill nets from the existing 7½", 8" and 8¼" to a standard 8" as required in Areas 1, 4, 3, and 7 under IPSFC proposals.

This will standardize all chinook gill net mesh limits and should not eliminate any nets presently in use.

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT G

(Exhibit G, entitled "Measurement of Water Quality with the Pacific Oyster Embryo Bioassay," by C. E. Woelke, follows on pages 584a to 584j, inclusive.)

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STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT H

(Exhibit H, entitled "Phytoplankton Photosynthesis and Its Relationship to Oxygen in Grays Harbor, Washington," by Ronald E. Westley, follows page 584j.)

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MR. POSTON: We have a statement next from the Congress of American Fishermen.

CONGRESS OF AMERICAN FISHERMEN

"Congress of American Fishermen, 2142 - 8th Avenue North, Seattle, Washington 98109, Telephone AT 4-6176

STATE OF WASHINGTON DEPARTMENT OF FISHERIES - EXHIBIT G

C. E. Woelke

Measurement of Water Quality with the Pacific Oyster Embryo Bioassay

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Published by:
American Society for Testing and Materials
1916 Race Street, Philadelphia, Pa. 19103

584b

C. E. Woelke[1]

Measurement of Water Quality with the Pacific Oyster Embryo Bioassay

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REFERENCE: C. E. Woelke, "**Measurement of Water Quality with the Pacific Oyster Embryo Bioassay,**" *Water Quality Criteria, ASTM STP 416*, Am. Soc. Testing Mats, 1967, p. 112.

ABSTRACT: Meaningful water quality standards or criteria must be expressed in terms of consumer needs. If these needs are based on chemical parameters, the criteria or standards should be based on chemical measurements. If consumer needs are based on biological factors, standards or criteria should be based on biological measurements. Methods have been developed in which Pacific oyster embryo bioassays measure water quality in terms of response by a type of animal (consumer) found in many of our bays and estuaries. The method has been successfully employed in the laboratory to measure relative toxicity of pulp and paper wastes. Both polluted and unpolluted water from bays and estuaries are routinely bioassayed with oyster embryos. Based on these bioassays, areas of acceptable and unacceptable water quality have been delineated relative to oysters. It is recommended that this method and similar bioassay techniques be adopted as part of the measurements employed in defining water quality standards and criteria.

KEY WORDS: water, water pollution, water quality, estuaries, bioassay, oysters, toxicity, molluscs, industrial wastes, pulp mills, paper mills, refineries

The previous papers have indicated some of the complexities involved in evaluating water quality in an environment subjected to wide short-term physical and chemical changes. While not specifically spelling it out, they have implied that the plethora of physical and chemical measurements in routine use may still not detect unsatisfactory biological conditions.

Biological assays are actually the most logical, and frequently the only available, method for defining water quality. Doudoroff et al [*1*][2] described a standardized bioassay procedure for fish, and Woelke [*2*] proposed the use of bivalve larva for bioassays of waters in which oyster

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[1] Washington State Department of Fisheries, Olympia, Wash.

[2] The italic numbers in brackets refer to the list of references appended to this paper.

584c

and clam populations are present. Bioassays with bivalve larva of simulated wastes prepared in the laboratory have been reported by a number of investigators [*3–10*]. Dimick and Breese [*11*] propose the bay mussel as a standard bivalve for marine water bioassays because these molluscs are found in nearly all estuarine areas in the world.

In this paper I shall give a brief description of a rapid, inexpensive, and dependable bioassay technique I developed while working for the Shellfish Research Unit of the Washington Department of Fisheries.

For the remainder of my presentation I shall deal with my subject in four steps. First, state the assumptions and justifications; second, describe the method itself; third, present data obtained in a series of toxicity bioassays conducted on 29 samples of pulp mill and oil refinery wastes; and fourth, describe how this technique has been extended to actual estuarine pollution problems.

In developing this technique I assumed a general acceptance of the need for and merit of biological assays in the field of water quality research. I further assumed an acceptance of the concept that development of a bioassay procedure with a commercially valuable marine organism, which could be applied at any time of the year with the same ease and reproducibility currently attributed to the biological oxygen demand and coliform mean probable number tests, would be a useful tool for evaluating water quality. It is my contention that the first 48 hr in the development of fertilized eggs of the Pacific oyster, *Crassostrea gigas*, provides a biological system whose response can be utilized to satisfy these assumptions. During this 48-hr period the fertilized eggs normally develop into free-swimming, fully shelled veliger larvae. My final assumption is that failure to develop to fully shelled (normal) larvae in 48 hr will break the life cycle of the Pacific oyster. I consider failure of the eggs to develop, or the proportion (per cent) of larvae developing in an abnormal manner to constitute a measure of the biological response to a particular stimulus.

Method

The basic steps I have followed in carrying out bioassays with fertilized Pacific oyster eggs are relatively simple and straight-forward. Adult oysters (spawners) are thermally conditioned at 20 C in flowing seawater until they can be readily spawned. This usually requires about four to six weeks. To insure the availability of spawners during all months of the year, several groups of oysters at various stages of sexual maturity are kept on hand at all times. Several hours before a bioassay is to be conducted, 10 to 20 mature oysters are placed into Pyrex dishes filled with filtered ultraviolet-light-treated water. These dishes are placed in a water bath and the temperature is raised to 28 to 30 C. About 30 min before the time the spawning is desired, a sperm suspension from

TABLE 1—*Levels of response of Pacific oyster embryonic development to waste samples bioassayed.*

Waste Number	No Effect[a]		20% Abnormal		50% Abnorma		100 % Abnormal		Controls % Abnormal
	PBI	Dilution	PBI	Dilution	PBI	Dilution	PBI	Dilution	
39	5	1:10,000	15.0	1:2100	19.5	1:1650	33	1:1000	0.40
40	0	<1:100,000	0.0	1:525	0.0	1:390	0	1:100	0.40
41	0	1:100	3.2	1:61	7.2	1:46	15	1:20	0.41
42	1	1:2000	5.2	1:145	8.2	1:112	89	1:20	0.41
43	6	1:10,000	13.0	1:4540	21.0	1:3000	68	1:1000	0.41
44	18	1:20,000	18.5	1:19,000	23.5	1:16,500	43	1:10,000	2.20
45	4	1:1000	13.5	1:72	19.5	1:50	50	1:20	2.20
46	5	1:100	14.0	1:22	18.0	1:17	30	1:10	2.20
47	<18	<1:1000	29.0	1:620	41.0	1:450	97	1:200	2.20
48	4	1:2000	8.4	1:920	13.0	1:600	36	1:200	2.20
62	2	1:20	>2.0	>1:10	>2.0	>1:10	>2	>1:10	0.05
63	3	1:100,000	17.5	1:11,500	28.0	1:7200	104	1:2000	0.05
64	1	1:1000	9.2	1:170	11.5	1:145	75	1:20	0.05
65	>0	>1:10	>0.0	>1:10	>0.0	>1:10	>0	>1:10	0.05
66	2	1:100,000	14.0	1:3400	24.0	1:1950	301	1:200	0.05
67	1	1:2000	<1.0	1:690	<1.0	1:500	1	1:200	0.98
68	0	1:10,000	5.7	1:68	7.8	1:48	17	1:20	0.98
69	0	1:200	1.5	1:65	2.1	1:47	5	1:20	0.98
70	0	1:100,000	1.4	1:7800	2.4	1:5400	10	1:2000	0.98
71	0	1:100,000	1.3	1:7900	2.1	1:5450	7	1:2000	0.98
72	0	1:100,000	9.1	1:550	11.5	1:475	22	1:200	0.98
73	...	1:1000	...	1:700	...	1:430	...	1:100	1.79
74	0	1:20	>0.0	>1:10	>0.0	>1:10	>0	>1:10	3.42
75	1	1:100	1.0	1:18	1.0	1:15	1	1:10	3.42
76	0	1:1000	1.2	1:59	20.0	1:39	6	1:10	0.58
77	0	1:2000	1.2	1:560	2.0	1:370	4	1:100	0.58
78	4	1:200	9.4	1:62	12.8	1:46	30	1:20	0.58
79	15	1:100	24.0	1:59	32.0	1:43	65	1:20	0.58
80	0	1:100	>4.0	>1:10	>4.0	>1:10	>4	>1:10	2.65

[a] Same as controls or nearly so.

a sexually mature, sacrificed male oyster is added to the water. The combination of increased temperature and sperm will induce one or more of the female oysters to spawn. Eggs from a single female are selected for use in the bioassay, and the number of eggs per unit volume are determined by sampling the sperm-egg suspension. Glass or plastic beakers containing the water to be bioassayed are each inoculated with a sufficient amount of the egg suspension to give 20,000 to 30,000 fertilized eggs per liter. Approximately 10 per cent of the cultures in a given bioassay are controls. The culture containers are placed in a 20 C water bath for 48 hr. At the end of this time the cultures are poured through a 37 μ sieve to collect the oyster larvae. Samples containing about 150 to 250 larvae taken from each culture are preserved and later examined under a microscope. The number of normal and abnormal

TABLE 2—*Wastes ranked and grouped from most toxic to least toxic, based on estimated dilution level which produced 20 per cent abnormal larvae.*

Toxicity Group	Waste Number	Description of Waste	Dilution Ratio	PBI
I........	44	alcohol plant	1:19,000	18.5
	63	diffuser line	1:11,500	17.5
II........	71	surge tank diffuser line	1:7900	1.3
	70	red stock washer	1:7800	1.4
III........	43	main sewer	1:4540	13.0
	66	diffuser	1:3400	14.0
	39	composite sewer	1:2100	15.0
IV........	48	bleach plant and lignin products	1:920	8.4
	73	kraft mill	1:700	...
	67	bleach plant sewer (chlorinator)	1:690	<1.0
	47	pulp wash	1:620	29.0
	77	bleach wash	1:560	1.2
	72	main mill sewer	1:550	9.1
	40	bleach plant waste	1:525	0.0
V........	64	main sewer	1:170	9.2
	42	screen room	1:145	5.2
VI........	45	board mill	1:72	13.5
	68	composite	1:68	5.7
	69	caustic extractor	1:65	1.5
	78	ground wood screenings	1:62	9.4
	41	barker waste	1:61	3.2
	76	main mill paper machine	1:59	1.2
	79	ground wood (refiner)	1:59	24.0
VII........	46	barker	1:22	14.0
	75	oil refinery	1:18	1.0
	62	white water	>1:10	>2.0
	65	paper machine	>1:10	>0.0
	74	oil refinery	>1:10	>0.0
	80	paper mill	>1.10	>4.0

TABLE 3—*Gallons of dilution water needed per day to reduce the waste streams toxicities to 0 and 20 per cent response levels.*

Sample No.	Bioassay Dilution		Present Waste Volume, million gallons per day	Million Gallons Per Day Required for	
	0 response	20% response		0 response	20% response
44	>20 000	19 000	2.74	>54 800	52 060
63	100 000	11 500	13.15	1 315 000	151 225
71	100 000	7 900	...	...	...
70	100 000	7 800	4.50	450 000	35 100
43	10 000	4 540	29.09	290 900	130 680
66	100 000	3 400	5.67	567 000	192 780
39	10 000	2 100	4.60	46 000	9 660
48	2 000	920	13.20	26 400	12 144
73	1 000	700	...	...	...
67	2 000	690	8.00	16 000	5 520
47	1 000	620	17.30	17 300	10 726
77	2 000	560	2.92	5 840	1 635
72	100 000	550	7.80	780 000	42 900
40	>100 000	525	0.70	>70 000	367
64	1 000	170	40.32	40 320	6 854
42	2 000	145	9.00	18 000	1 305
45	1 000	72	1.13	1 130	81
68	10 000	68	...	...	...
69	200	65	5.00	1 000	325
78	200	62	0.91	182	56
41	100	61	0.70	70	43
76	1 000	59	5.90	5 900	348
79	100	59	1.34	134	79
46	100	22	1.43	143	31
75	100	18	...	...	...
62	20	<10	3.49	69.8	<35
65	<10	<10	8.40	<84	<84
74	20	<10	...	...	...
80	100	<10	...	...	...
Totals			187.29	3 706 273	654 038

larvae are counted in each sample. The response which forms the basis of the bioassay is the per cent abnormal larvae. The effect of any variable tested is described in terms of the per cent oyster larvae which develop abnormally.

Results

In a study comparing the toxicity of 29 composite wastes serial dilutions of one part waste sample to 10, 20, 100, 200, 1000, 2000, 10,000, 20,000, 100,000, and 200,000 parts of fresh seawater were prepared. Each dilution was divided between three one-liter beakers for replication of the bioassay. At least nine beakers were filled with pure seawater to be used as controls in each of the nine separate bioassays made during the study. The mean per cent abnormal larvae from each dilution of each waste bioassayed was plotted on probability paper, and levels of no

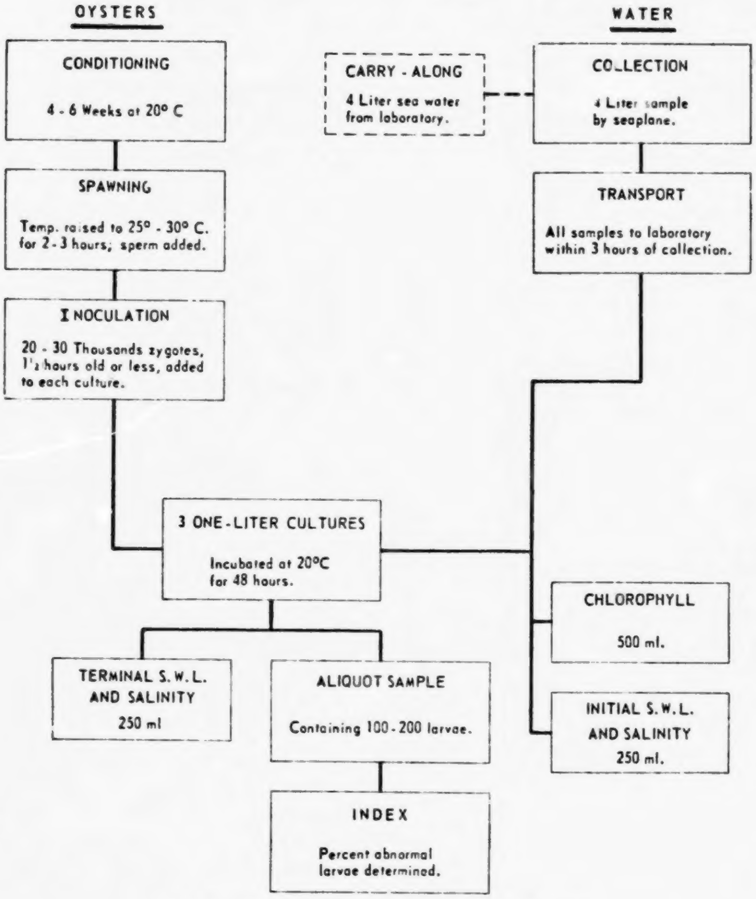
OYSTERS
WATER
CONDITIONING
4 - 6 Weeks at 20° C
SPAWNING
Temp. raised to 25° - 30° C. for 2 - 3 hours; sperm added.
INOCULATION
20 - 30 Thousands zygotes, 1½ hours old or less, added to each culture.
CARRY - ALONG
4 Liter sea water from laboratory.
COLLECTION
4 Liter sample by seaplane.
TRANSPORT
All samples to laboratory within 3 hours of collection.
3 ONE-LITER CULTURES
Incubated at 20°C for 48 hours.
CHLOROPHYLL
500 ml.
TERMINAL S. W. L. AND SALINITY
250 ml
ALIQUOT SAMPLE
Containing 100 - 200 larvae.
INITIAL S. W. L. AND SALINITY
250 ml.
INDEX
Percent abnormal larvae determined.

FIG. 1—*Flow diagram for oyster larva bioassay.*

effect, 20, 50, and 100 per cent abnormals (response), were determined. The Pearl-Benson Index (PBI), a chemical measure commonly used for measuring pulp and paper wastes, was determined for each dilution of each waste bioassayed. The results of this study are shown in Table 1. In Table 2 these wastes are arranged in order from most to least toxic, based on the amount of dilution needed to reduce their toxicity to the 20 per cent abnormal level. It should be noted that when ranked in this manner, the PBI values for the waste dilutions designated do not follow any particular pattern. This indicates that the PBI does not measure the relative toxicity of the different wastes. To give a more practical description of these results, the gallons of dilution water needed to reduce

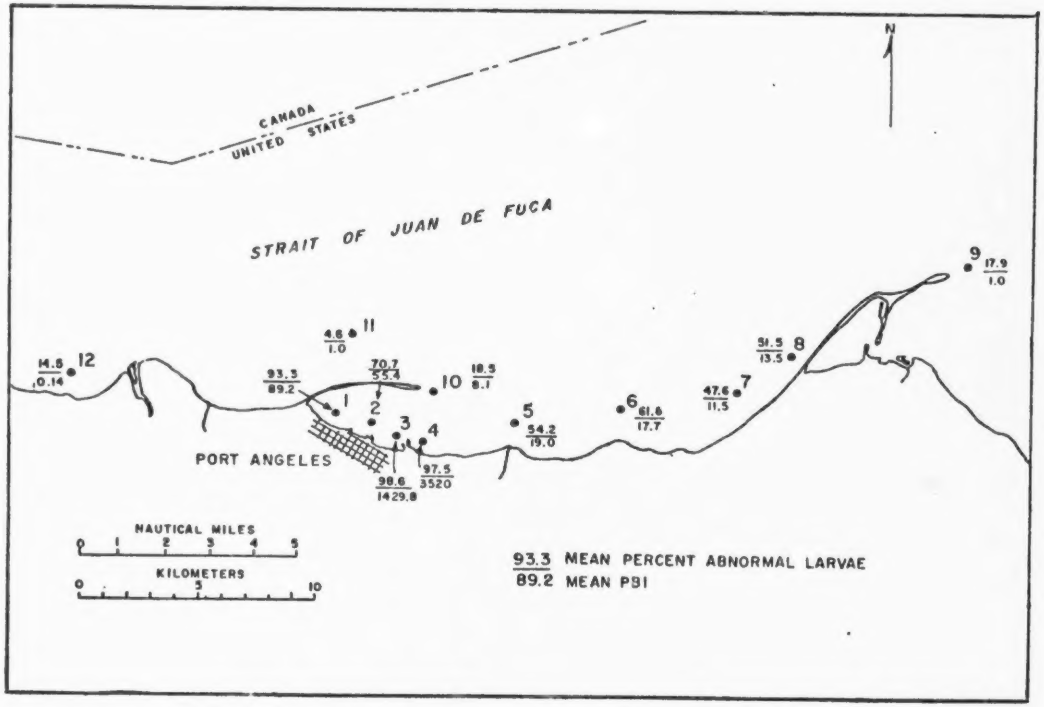

FIG. 2—*Port Angeles, Wash., stations for oyster larva bioassay samples.*

the waste streams bioassayed to the 0 and 20 per cent response levels are summarized in Table 3.

In a further refinement of this bioassay procedure, water samples are collected by airplane from various estuarine environments and are flown to the laboratory where they are bioassayed within a few hours of the time collected. In this type of bioassay, a control water sample is carried from the laboratory on the airplane and is subject to the same handling stresses as the samples to be bioassayed. The water is collected in one-gallon polyethylene containers. As many as 50 water samples have been collected for a single bioassay. These samples are divided between four one-liter beakers. Three samples are inoculated with freshly spawned oyster embryos, and the fourth is used for chemical analysis. At the end of the 48-hr bioassay, further chemical measures are often made on the waters in which the embryos actually developed. The flow diagram in Fig. 1 outlines the procedure followed in this type of bioassay. Average per cent abnormal larvae and average PBI values from seven consecutive monthly bioassays in one area of Washington state are summarized in Fig. 2. High larva response levels in the Port Angeles area which decrease with increasing distance from Port Angeles are readily apparent. At present, water quality is being monitored annually with oyster larvae at more than 130 stations, which include 95 per cent of the oyster growing areas of Washington state and over 80 per cent of the estuarine areas of the state.

Conclusions

I feel that the results achieved with the oyster embryo bioassay justifies considering it for general use in:

1. Evaluating existing estuarine water quality.
2. Monitoring estuarine water quality.
3. Determining toxicity of new potentially toxic materials.
4. Measuring relative toxicity of wastes or potential wastes and estimating their probable effect on molluscan populations.
5. Aiding in determining the degree and type of treatment a particular waste might require.
6. Evaluating the effectiveness of waste treatment facilities discharging into estuarine waters.
7. Establishing estuarine water quality standards.

Among the advantages of this method are its speed (relative to many other types of bioassays), its simplicity, its low cost, the fact that it is based on a commercially valuable species, the availability of test organisms on a 12-month basis, and the clear-cut response of the oyster embryos. While not mentioned previously, biological problems such as age, size, sex, and prior exposure of the animals to stress, which tend to confound the results of bioassays with many other organisms, are not present with this method, since all embryos have the same parents and are exactly the same age and size.

I would be less than honest if I did not caution that while the results of oyster embryo bioassays can be used with a fair degree of confidence when defining water quality for molluscs, the extension of the results to crabs, shrimp, swimming fish, diatoms, or the plankton forms on which these animals feed may be a hazardous and ill-advised procedure. At present it appears that where water quality does not interfere with embryonic development of oyster larvae, other animal forms will thrive. In spite of this it is my firm belief that similar bioassay procedures must be developed with species representing the other major groups of organisms found in the estuarine environment, particularly those of social or economic importance to man.

I feel strongly that water quality criteria must include bioassay measurements of water of the type outlined here, in addition to chemical or physical measurements.

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PHYTOPLANKTON PHOTOSYNTHESIS AND ITS RELATIONSHIP TO OXYGEN IN GRAYS HARBOR, WASHINGTON

State of Washington
DEPARTMENT OF FISHERIES
Research Division

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
EXHIBIT H

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March 1967

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ABSTRACT

A study has been carried out by the Washington Department of Fisheries to determine the contribution from phytoplankton photosynthesis to the dissolved oxygen content of the waters of Grays Harbor. It was found that phytoplankton photosynthesis is inhibited in Upper Grays Harbor because of water turbidity and some undetermined inhibiting factor. Sulfite waste liquor contributed to the turbidity and was a factor in the low inorganic phosphate content of the water. It was calculated that the waters of Upper Grays Harbor failed to receive about 1.7 parts per million (ppm) of dissolved oxygen every 10 days during summer due to the reduced phytoplankton photosynthesis.

INTRODUCTION

Because of concern about water quality conditions and possible deleterious effects on salmon, there has been considerable investigation of the water conditions of Grays Harbor. Particular attention had been directed to the problem of low dissolved oxygen content in the upper portion of the estuary. During the summer of 1964 and 1965, a study of the general hydrography and the primary productivity of Grays Harbor was carried out by the Washington Department of Fisheries as a contribution to the Grays Harbor Cooperative Study Program.[1/] This study was undertaken to gather further information on the general water conditions of the harbor, to gain information on the nutrients and conditions important to primary productivity, to determine the levels of primary productivity; and, since low dissolved oxygen is a major problem in parts of Grays Harbor, ultimately to determine the contribution of oxygen from phytoplankton photosynthesis. The complete data collected have already been presented in Washington State Department of Fisheries Hydrographic Data Bulletin, Vol. V, No. 1 (Westley and Tarr, 1965). This present report gives a summary and analysis of that data from the above bulletin which relates to primary productivity in Grays Harbor, with particular attention to the contribution of oxygen from phytoplankton photosynthesis. For comparative purposes a summary and analysis of similar data from Willapa Bay is also presented.

Grays Harbor is a broad, shallow estuary located on the Washington coast about 35 miles north of the mouth of the Columbia River. Surface area of the harbor is about 90 miles^2, maximum water depth is about 60 ft and a majority of the bottom is exposed at low tide. The estuary is fed directly from the Pacific Ocean. Major tributary streams are the Chehalis, Wishkah, Hoquiam, and Humptulips rivers.

METHODS

The location of the stations used in the study is shown in Figure 1. Each station was sampled at four depths simultaneously. Water properties

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[1/] A cooperative investigation of the pollution problem in Grays Harbor by Washington State Departments of Fisheries and Game, Washington State Pollution Control Commission, United States Geological Survey, and Weyerhaeuser Timber Co.

measured were salinity, dissolved oxygen content, temperature, sulfite waste liquor (SWL), inorganic and total phosphate, nitrite, nitrate and ammonia, pH, and alkalinity. The phytoplankton was evaluated by determination of photosynthetic rate through uptake of radioactive carbon, and determination of the standing crop was made through chlorophyll extraction and microscopic examination. In general, the methods used were those presented by Strickland and Parsons (1965). SWL was measured by the method presented by Westley (1960). Samples for determination of photosynthetic rate were held in a deck incubator exposed to natural sunlight with appropriate neutral density filters to compensate for water turbidity. Trips were planned to sample the area of the harbor mouth at high tide and the upper harbor at low tide. Insofar as possible sampling was done against the direction of tidal flow. Station 17 was intended to measure the ocean feed water. Station 2 was intended to measure the inflowing Chehalis River water.

In Grays Harbor, Trip 8 was on August 18, 1964; Trip 9 on September 9, 1964; Trip 10 on July 21, 1965; Trip 11 on August 18, 1965; and Trip 12 on September 21, 1965. In Willapa Bay, Trip 29 was on August 12, 1964; Trip 30 on September 2, 1964; Trip 38 on July 15, 1965; Trip 40 on August 25, 1965; and Trip 41 on September 14. 1965.

RESULTS

The Grays Harbor station data were combined into five units representing five major sections of the bay (Figure 1). Data from all depths and all stations in each section were averaged to provide one value in each section for each property for each trip. Figure 2 presents the water temperature data, Figure 3 presents the salinity data, Figure 4 presents the sulfite waste liquor data, Figure 5 presents the dissolved oxygen data, Figure 6 presents the inorganic phosphate data, Figure 7 presents the total phosphate information, Figure 8 the Secchi disc observations, Figure 9 chlorophyll A, Figure 10 photosynthetic rate, and Figure 11 presents calculations of photosynthetic efficiency expressed as assimilation numbers (the amount of photosynthesis per unit of chlorophyll A per 1,000 foot candles [ft-c]).

These data show that the lowest average oxygen values on each trip always occurred in Section II and the highest occurred at Section V (in the mouth). The SWL values were highest in Section II and the lowest in Section V.

Inorganic phosphate was lowest in Section II and highest in Section V. Total phosphate was highest in Section II and lowest in Section I. Chlorophyll A was lowest in Section I, slightly higher in Section II, and thereafter increasing. with the highest values observed in Section V. The data on photosynthetic rate indicates the lowest levels to occur in Section II and the highest in Section V. Water turbidity was greatest in Section II and lowest in Section V.

DISCUSSION

General

A major objective was to determine the contribution of oxygen from phytoplankton photosynthesis to the water of Grays Harbor. The data indicate lowest oxygen values and lowest photosynthetic rates both occur in Section II. Therefore the data were closely examined to determine the reason for the lack of photosynthesis in this area. The chlorophyll data shows that some plankton is present in Section II but the low photosynthetic rate and the low assimilation numbers indicate that the phytoplankton present, if alive, are not photosynthesizing. The data also demonstrate that water turbidity is quite high in Section II, inorganic phosphate is quite low, and organic phosphorus is high. The highest photosynthetic rate occurred when the Secchi disc values (light penetration) were greatest (Trip 8) and lowest photosynthetic rate occurred when Secchi disc values were lowest (the higher the value the clearer the water). The magnitude of the differences in the Secchi disc observations, however, is not great. Of the above, information relative to phosphate and water turbidity seem particularly important.

Inorganic phosphate is needed for primary productivity, and, in general, particulate organic phosphorus is not immediately available for primary productivity. Turbidity of the water decreases light penetration and causes a corresponding decrease in the photosynthetic rate.

To evaluate the findings in Grays Harbor from a different point of view, comparisons were made with similar data from Willapa Bay. Willapa Bay is similar to Grays Harbor in many respects. It is located on the coast of Washington immediately south of Grays Harbor. Surface area is about 100 miles^2 and the bay is generally shallow with a majority of the bottom exposed at low tide. The Department of Fisheries has been carrying on a major hydrographic study of Willapa Bay since 1961. This study has been for the purpose of establishing the general features of the water, for measuring levels of primary productivity in the bay, and for determining the exchange of water between Willapa Bay and the ocean. While Willapa Bay and Grays Harbor are as similar as any two estuaries can be, we do recognize differences between them and do not consider Willapa Bay an identical control. Data from five trips in Willapa Bay, carried out at almost the same time as the Grays Harbor trips, were treated in the same manner as the Grays Harbor data (Figure 1). This information is presented in Figures 12 through 21. There is no direct discharge of SWL into Willapa Bay. The SWL values shown in Figure 14 are primarily due to so-called "natural background". It is, however, possible for minimal amounts of SWL to enter Willapa Bay with the ocean feed water.

In Willapa Bay relatively high chlorophyll A and high photosynthetic rate values were found in Section II. The assimilation number shows a relatively high photosynthetic efficiency and there was also considerably more inorganic phosphate present in Section II of Willapa Bay (Figure 1). In general these conditions observed in Section II are almost the opposite of those observed in Section II of Grays Harbor. The conditions observed in Willapa Bay seem typical of what has been found in many other estuaries, with interrelationship between flushing, nutrients, and photosynthesis resulting in a phtosynthetic peak in the head of the estuary.

Because of the presence of SWL, the Grays Harbor data were compared with results from previous studies carried out in this laboratory (Westley and Tarr, 1966), on determination of some effects of SWL on seawater using ammonia base liquor in concentrations up to 128 ppm. From these laboratory studies it appears that the levels of SWL observed in Grays Harbor were not high enough to inhibit photosynthesis through direct toxicity. However, in these laboratory studies it was observed that in the presence of SWL a majority of the inorganic phosphate is converted to the organic form and also that a fairly dense brown bloom develops in the water. Figures 6 and 7 illustrate the low inorganic phosphate and the high total phosphate that occurs in Section II of Grays Harbor and it appears that the SWL present is affecting both water turbidity and inorganic phosphate content of the water.

The data collected show that the rate of phytoplankton photosynthesis was very low in Section II of Grays Harbor during the fall of 1964 and 1965. Comparisons with Willapa Bay, and with laboratory studies provide some understanding of why primary productivity was low. A major factor in the reduced photosynthesis in Section II of Grays Harbor seems to be reduced light penetration or turbidity. However, photosynthetic efficiency expressed in terms of an assimilation number indicates that photosynthesis is also inhibited by some other cause. The data do not clearly indicate the reason for this additional inhibition. However, the highest levels of SWL were observed in Section II. Thus, lack of light penetration and some undetermined inhibiting condition are the immediate reasons for lack of photosynthesis in Upper Grays Harbor. The data also indicate that if these inhibiting conditions were corrected the problem created by the conversion of inorganic phosphate to organic phosphate by SWL would then soon block any major increase of photosynthesis in Section II of Grays Harbor.

The reason for the turbidity seems to be a combination of factors. The Secchi disc data and the SWL data indicate a general relationship, with the higher SWL values corresponding to the low light penetration. The notable exception to this is Trip 9 when both the SWL and Secchi disc values (light penetration) were the lowest observed. At that time the water of the entire bay was observed to be quite muddy.

Primary productivity of water is a complex subject, and it is not the writer's intent to imply that turbidity and SWL are the only factors influencing primary productivity in Section II of Grays Harbor. However, the data seem to indicate fairly clearly that both turbidity and SWL are major factors in reduced phytoplankton photosynthesis in Section II of Grays Harbor.

Effect of reduced photosynthetic rate on dissolved oxygen content of the water of Upper Grays Harbor.

The process of photosynthesis is known to be an important source of oxygen to water and in studies carried out by various workers relatively high dissolved oxygen content of the water has been observed to result from major photosynthetic activity. To make an estimate of the oxygen deficit in Grays Harbor due to reduced phytoplankton photosynthesis it is necessary to first estimate the extent that photosynthesis is depressed in Grays Harbor.

For this purpose we assumed that the photosynthetic rate in Section II of Grays Harbor should be similar to that of Willapa Bay. This assumption is based upon the similar size, and tidal range of the two bays. Their proximity provides similar weather conditions and a great deal of similarity in the composition of the ocean feed water. The available data suggest somewhat similar rates of exchange with the ocean, but Grays Harbor does receive more fresh water than Willapa Bay.

We averaged the photosynthetic rate observed on the 5 trips in Section II of Grays Harbor and compared this average with similar values derived for Willapa Bay. The difference was 6.44 milligrams (mg) carbon per cubic meter per hour. (These data are uncorrected for variation in light intensity). Then using the formula suggested by Westlake (1963) (grams oxygen x 0.300 = grams carbon) and using a P Q of 1.25, assuming 12 hours of effective light per day and that the radioactive carbon method with a dark bottle correction measures net photosynthesis; and applying a correction factor for nightime (dark) respiration from Westlake (1963) and Ryther (1959), we calculated that due to reduced photosynthesis, the waters of Section II of Grays Harbor have failed to receive the equivalent of .17 ppm dissolved oxygen each day or 1.7 ppm dissolved oxygen for each 10-day period during the summer. While several assumptions were made for this calculation, we have tried to be conservative in these assumptions. Therefore, the actual value should be at least as great as .17 ppm per day. The significance of this is that this potential cumulative oxygen production per 10-day period (1.7 ppm) is equal to one-half of the amount of oxygen present in the waters of Upper Grays Harbor during the seasonal oxygen minimum (3.0 ppm).

SUMMARY

A limited study was carried out to learn the contribution of oxygen from photosynthesis to the waters of Grays Harbor. It was demonstrated that photosynthesis is nearly absent in the upper portion of Grays Harbor (Section II), the area where the lowest dissolved oxygen values occur. Turbidity of the water is a major season for the lack of photosynthesis. By comparing the data with previous studies it is indicated that SWL interacts with other factors to reduce photosynthesis both by increasing turbidity and by converting inorganic phosphate to organic phosphate.

Calculations indicate that if the photosynthetic rate had not been depressed, the water of Section II of Grays Harbor would have received the equivalent of 1.7 ppm more of dissolved oxygen every 10 days during the summer.

585l

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APPENDIX

Figures 1 through 21

Pages 10 through 30

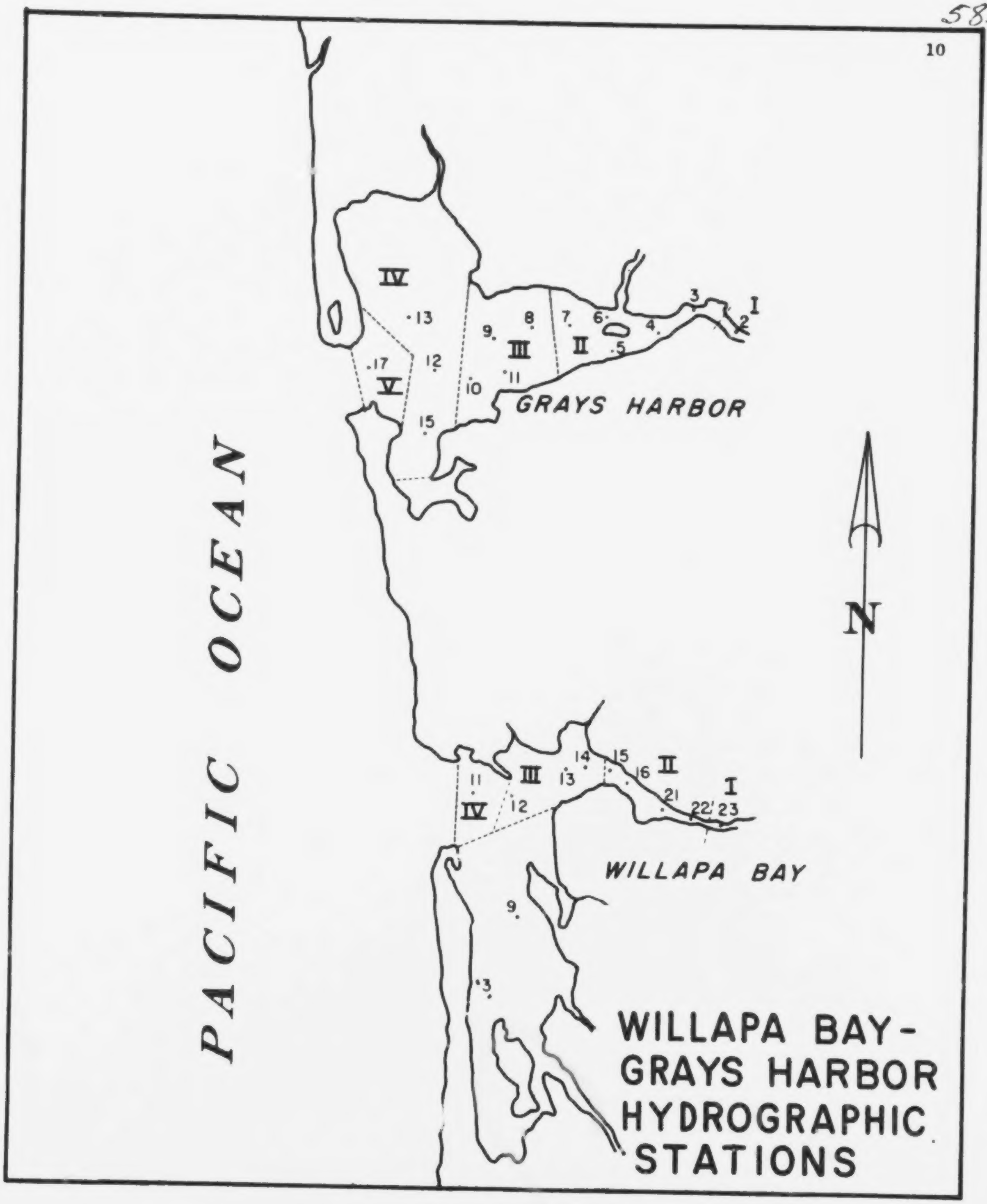

Figure 1. Map of study area.

5850

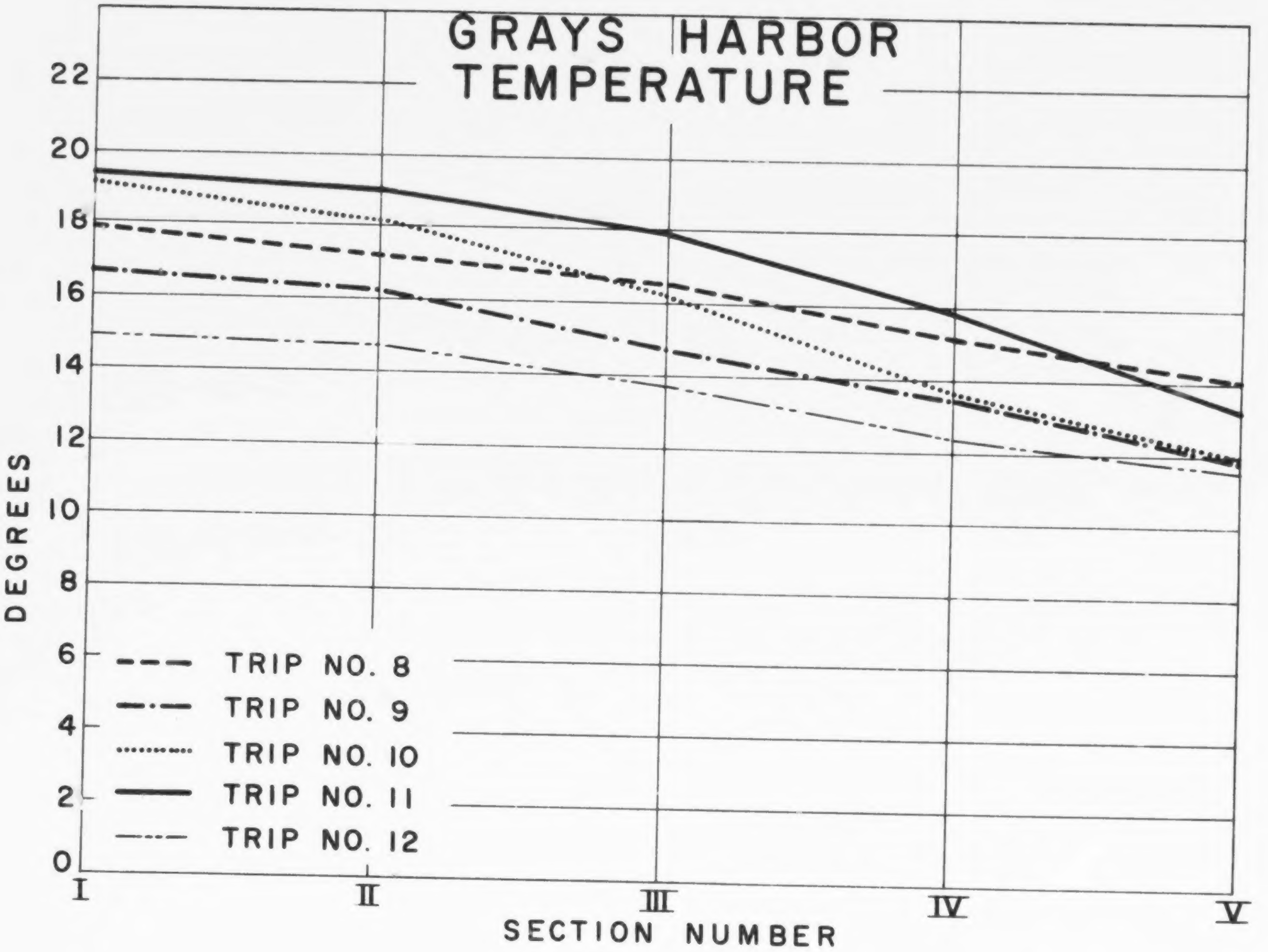

Figure 2. Grays Harbor temperature.

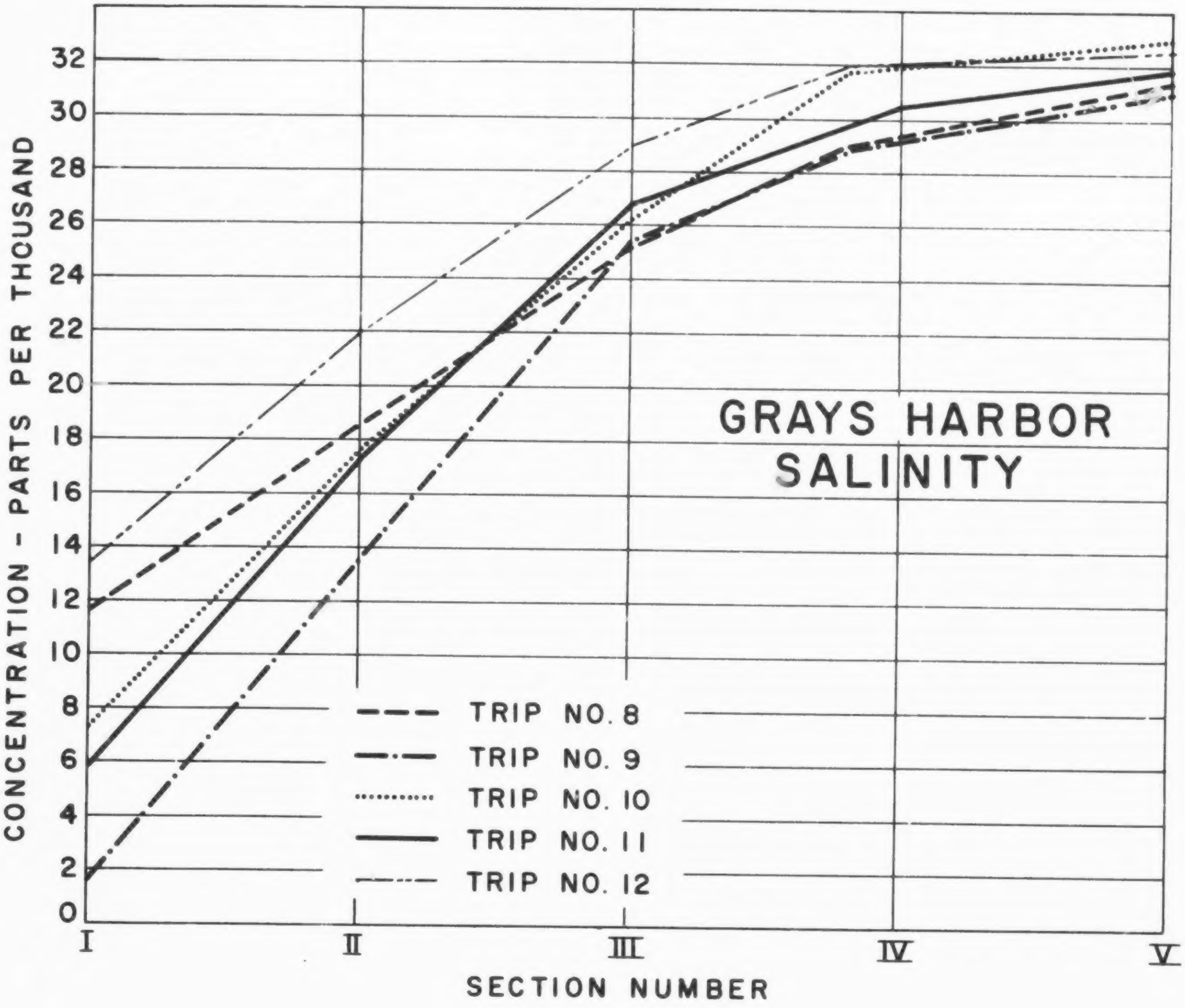

Figure 3. Grays Harbor salinity.

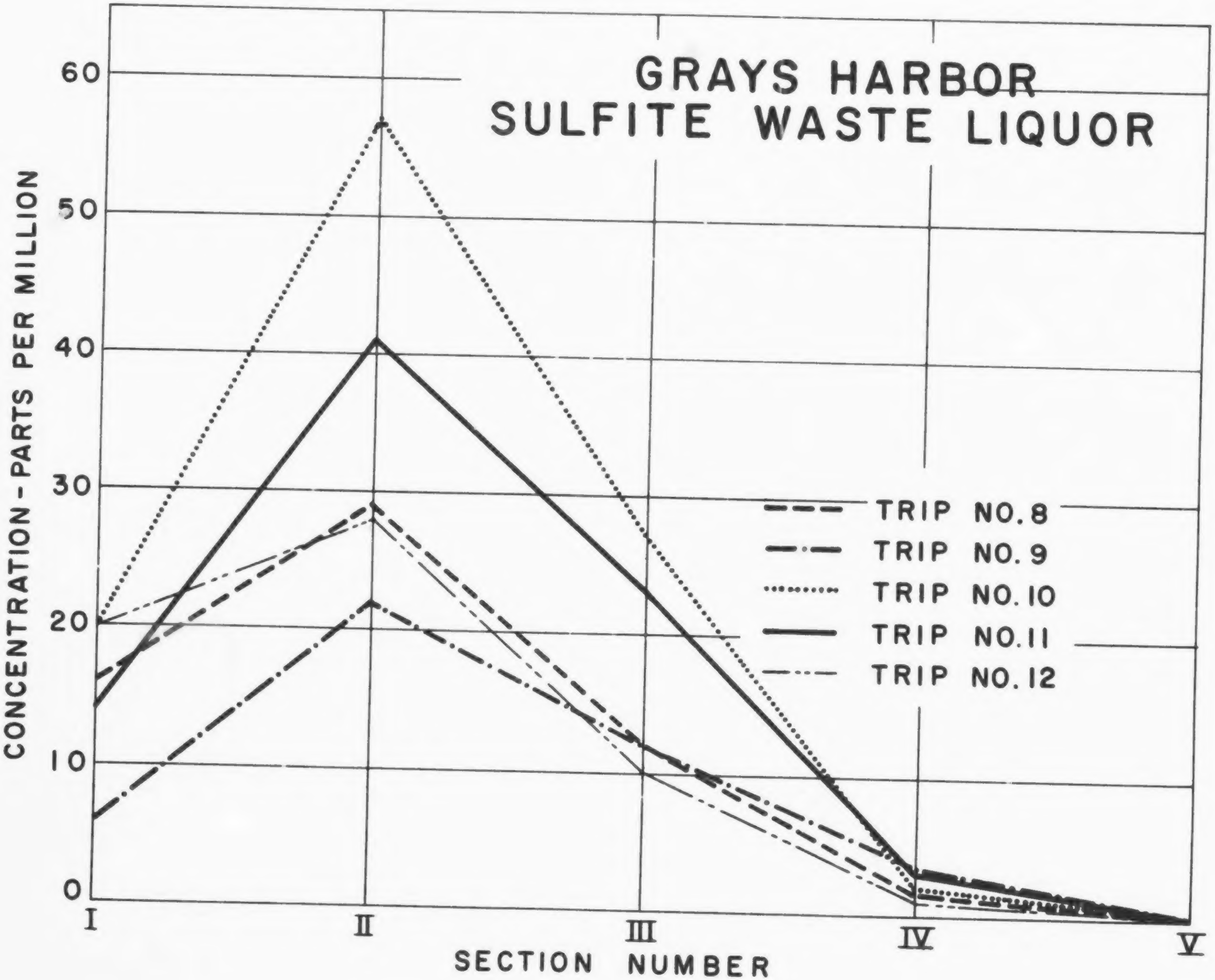

Figure 4. Grays Harbor sulfite waste liquor.

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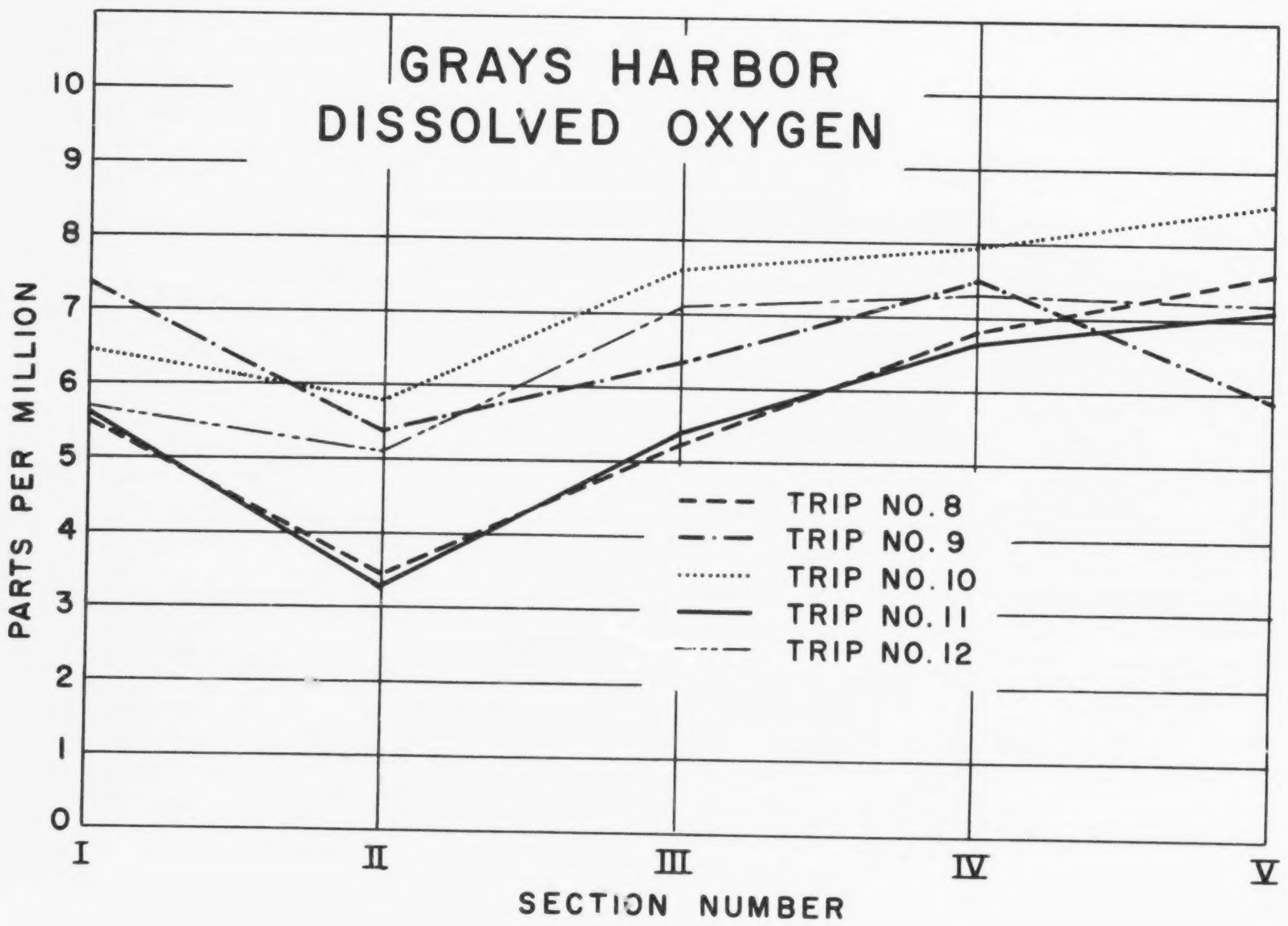

Figure 5. Grays Harbor dissolved oxygen.

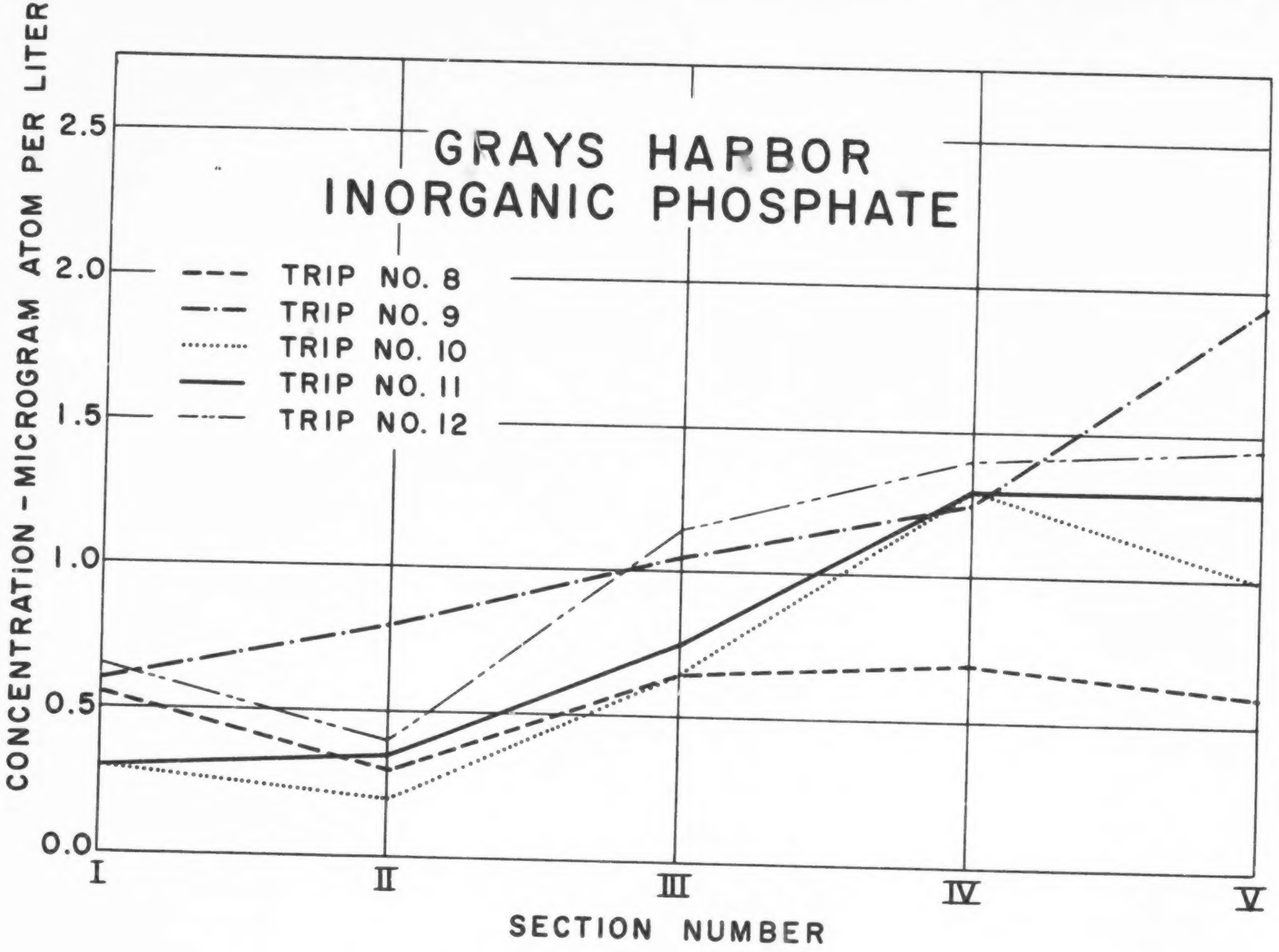

Figure 6. Grays Harbor inorganic phosphate.

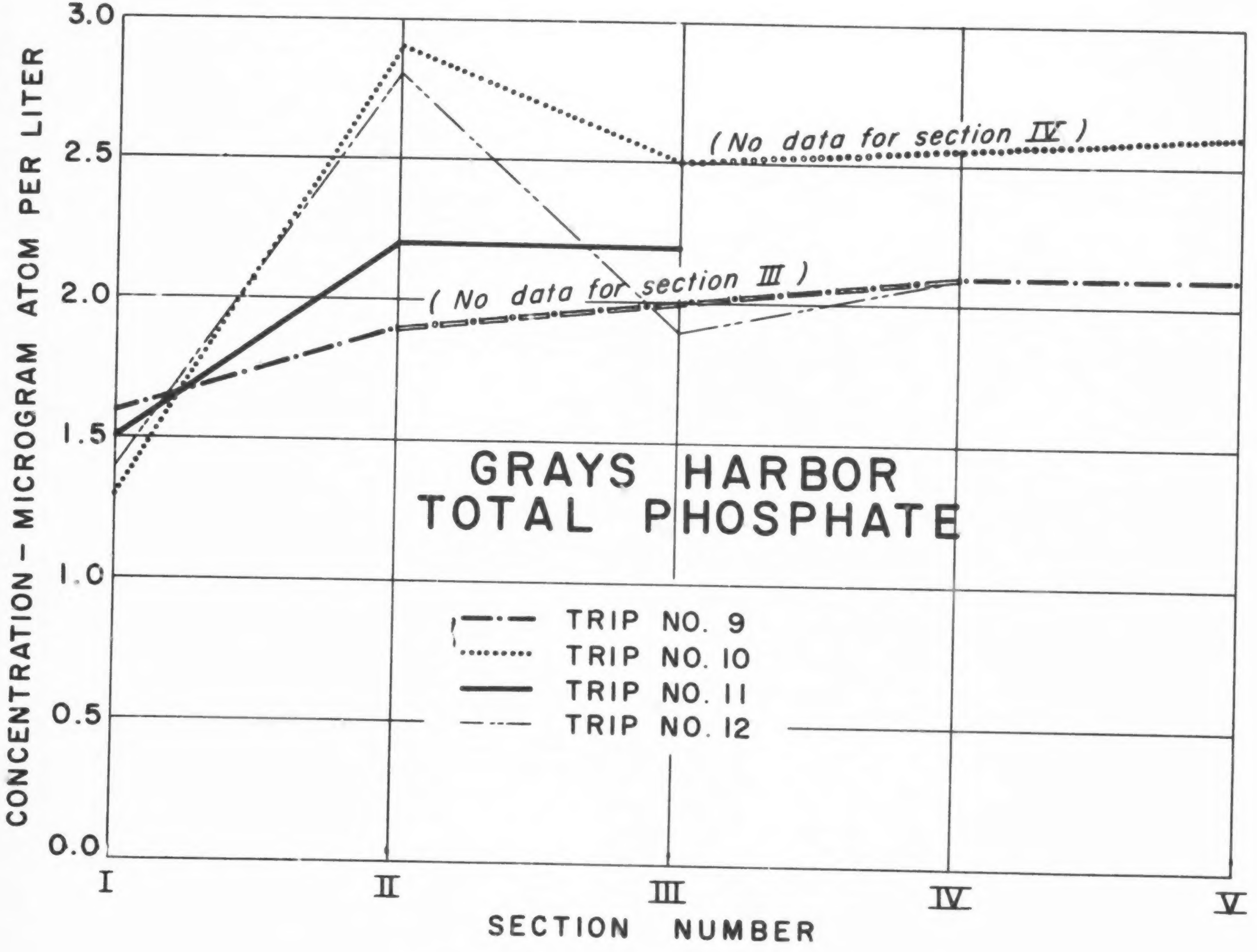

Figure 7. Grays Harbor total phosphate.

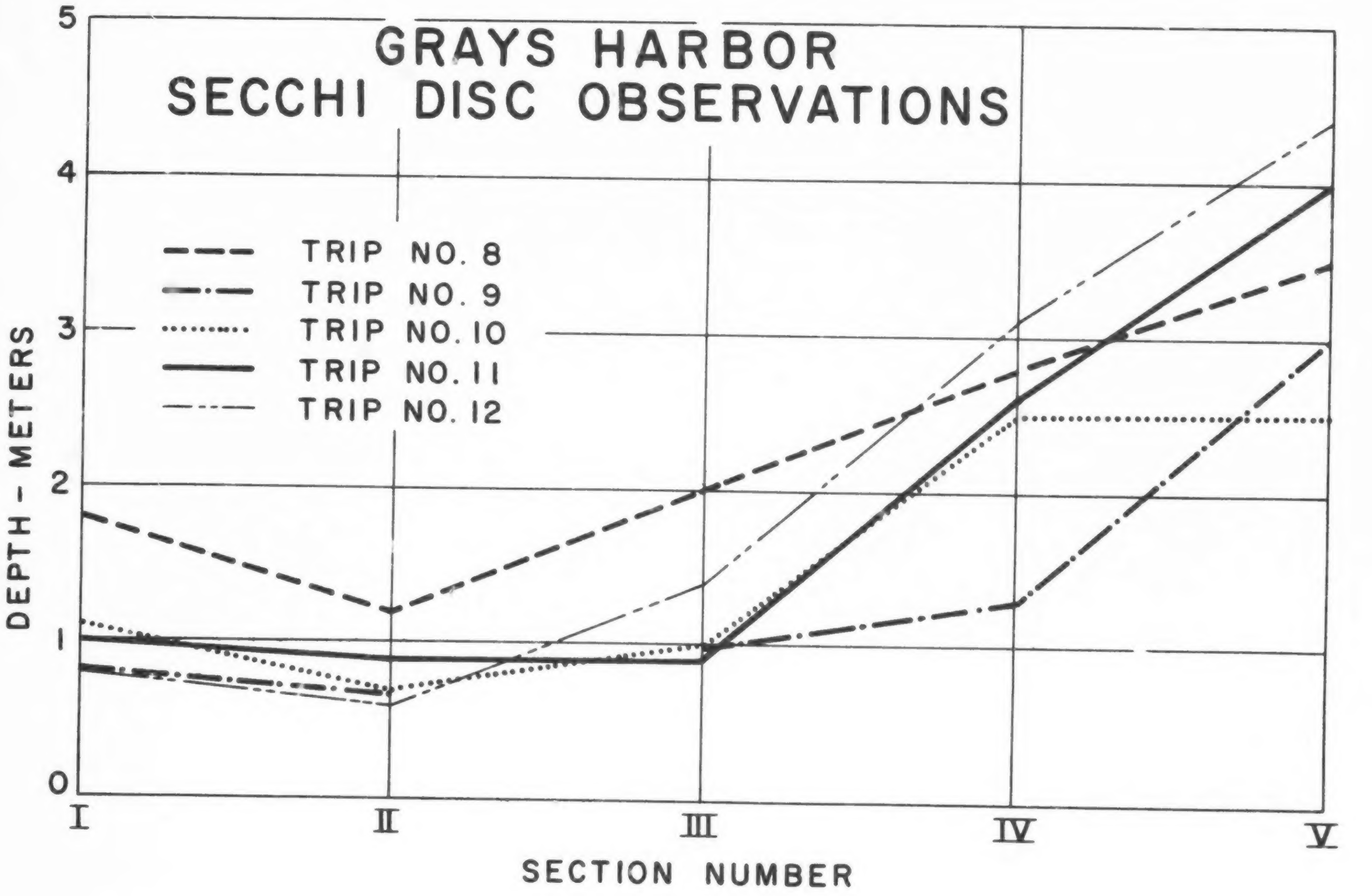

Figure 8. Grays Harbor Secchi disc observations.

585 0

585✓

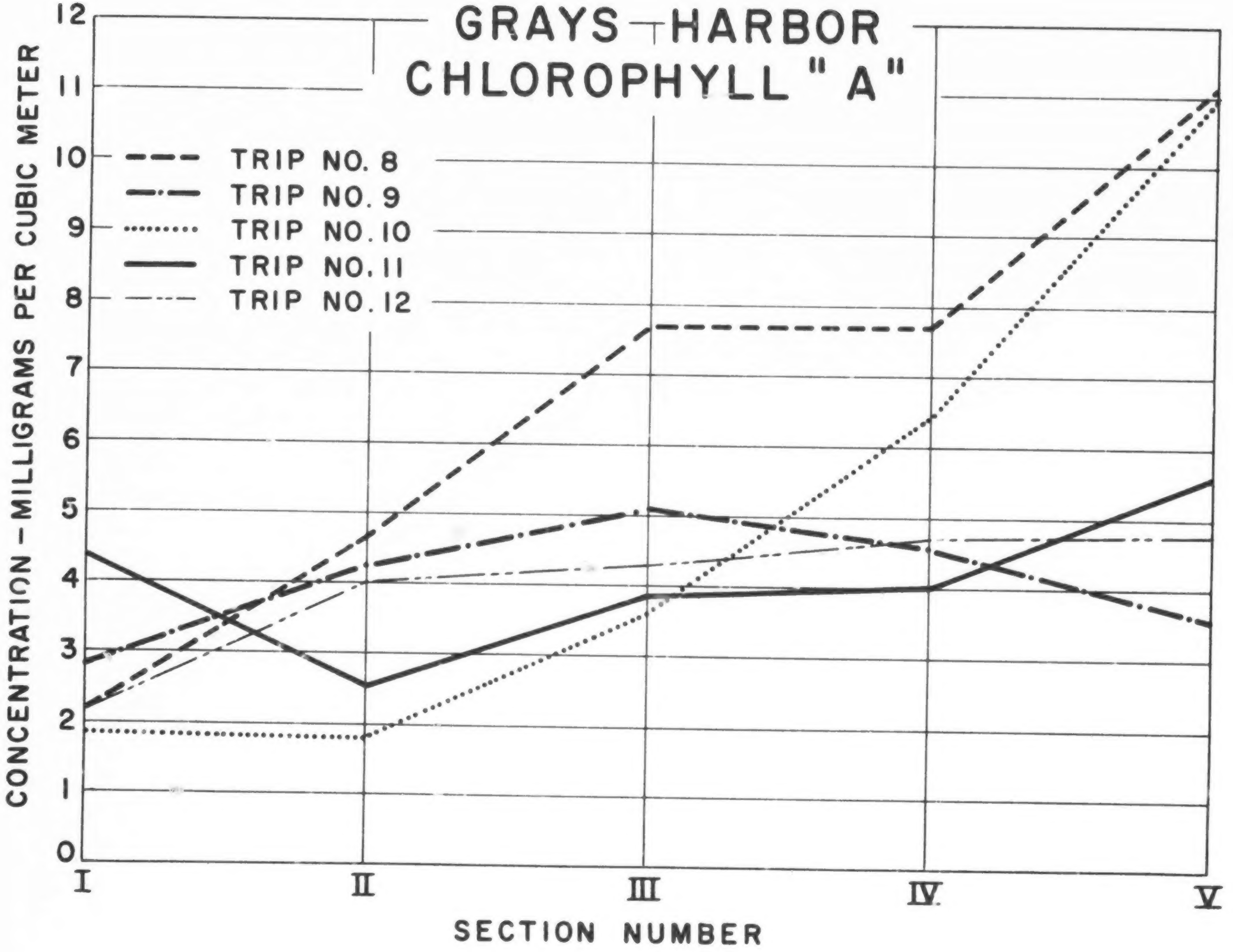

Figure 9. Grays Harbor chlorophyll A.

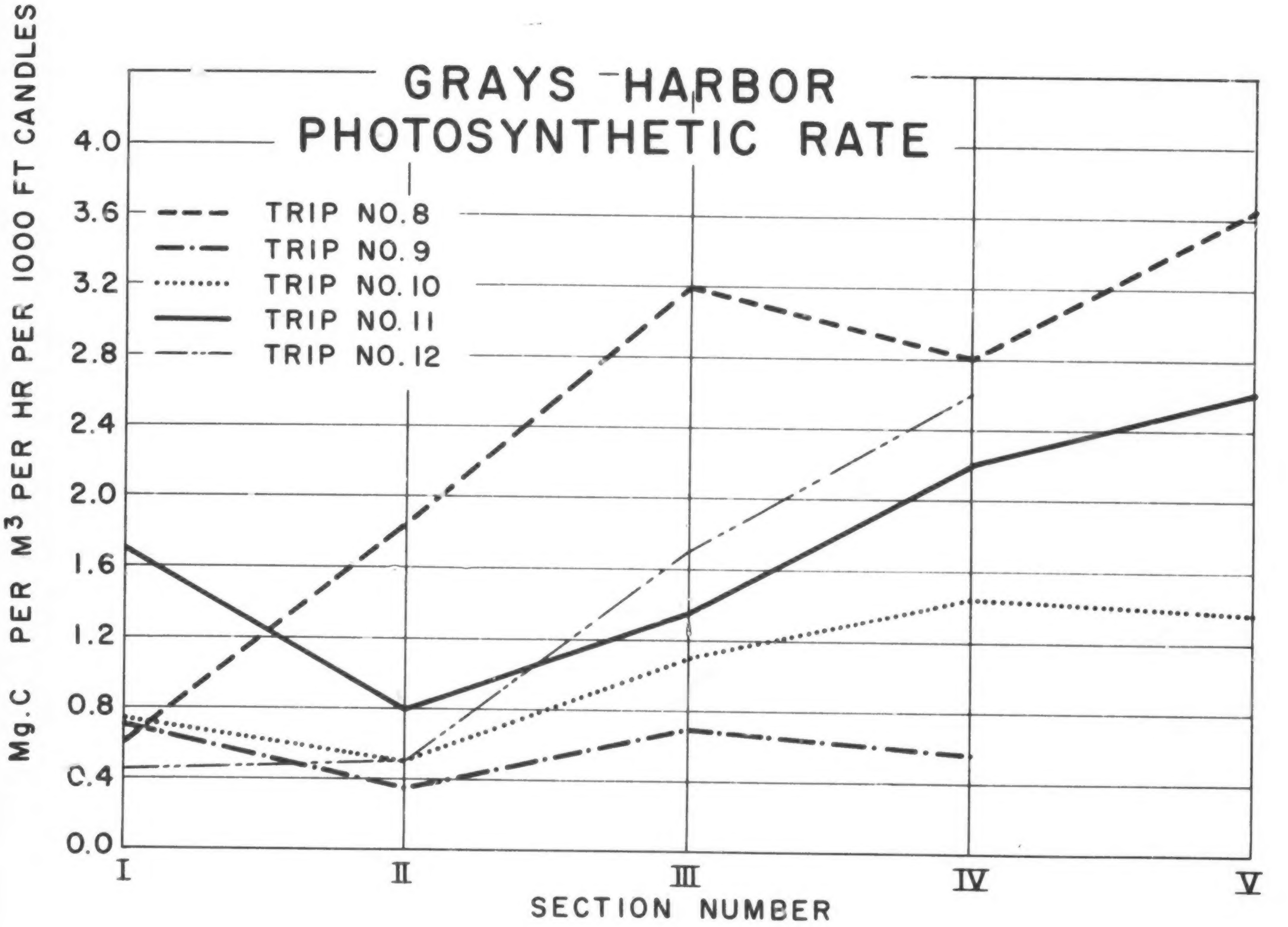

Figure 10. Grays Harbor photosynthetic rate.

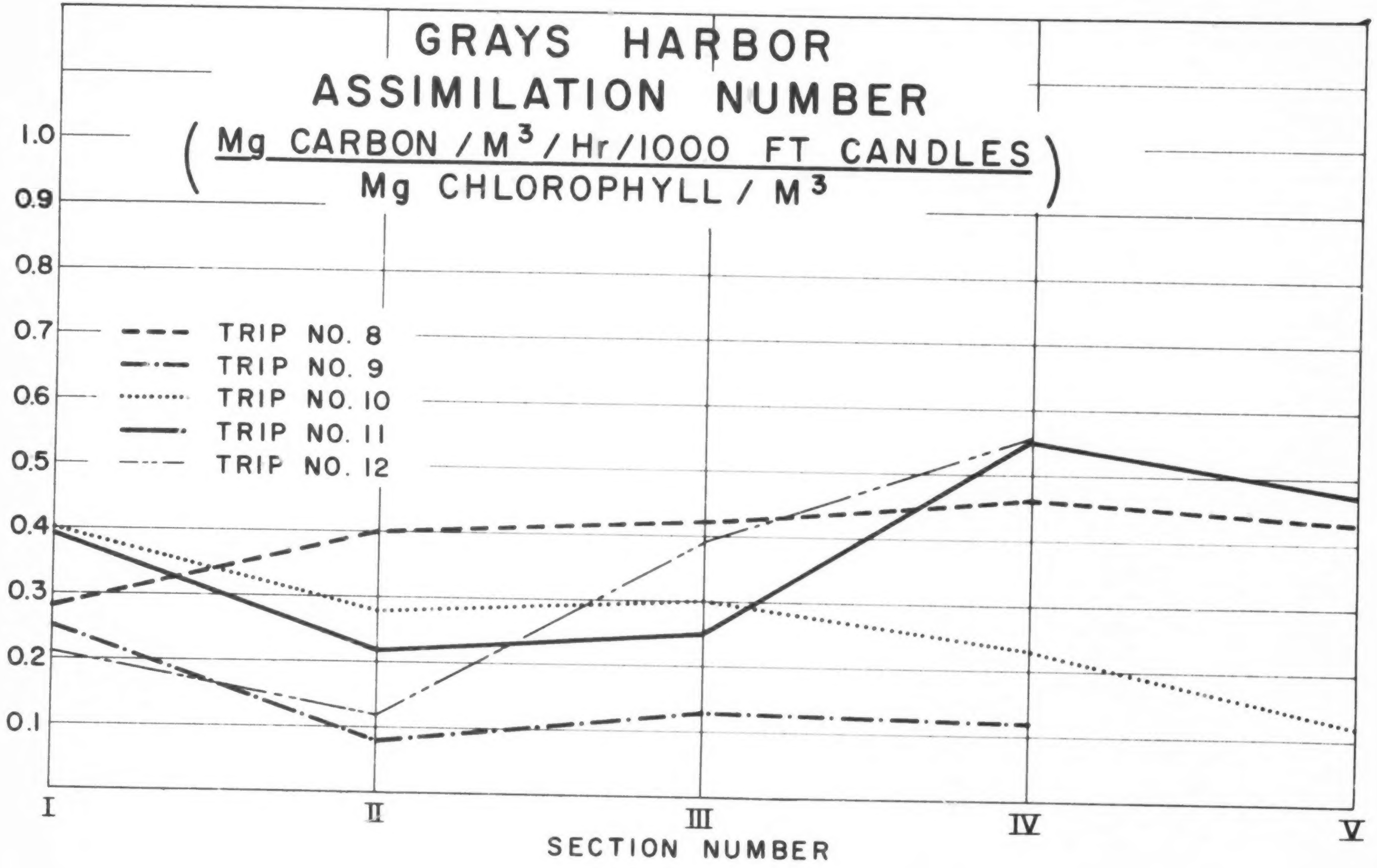

Figure 11. Grays Harbor assimilation number.

585x

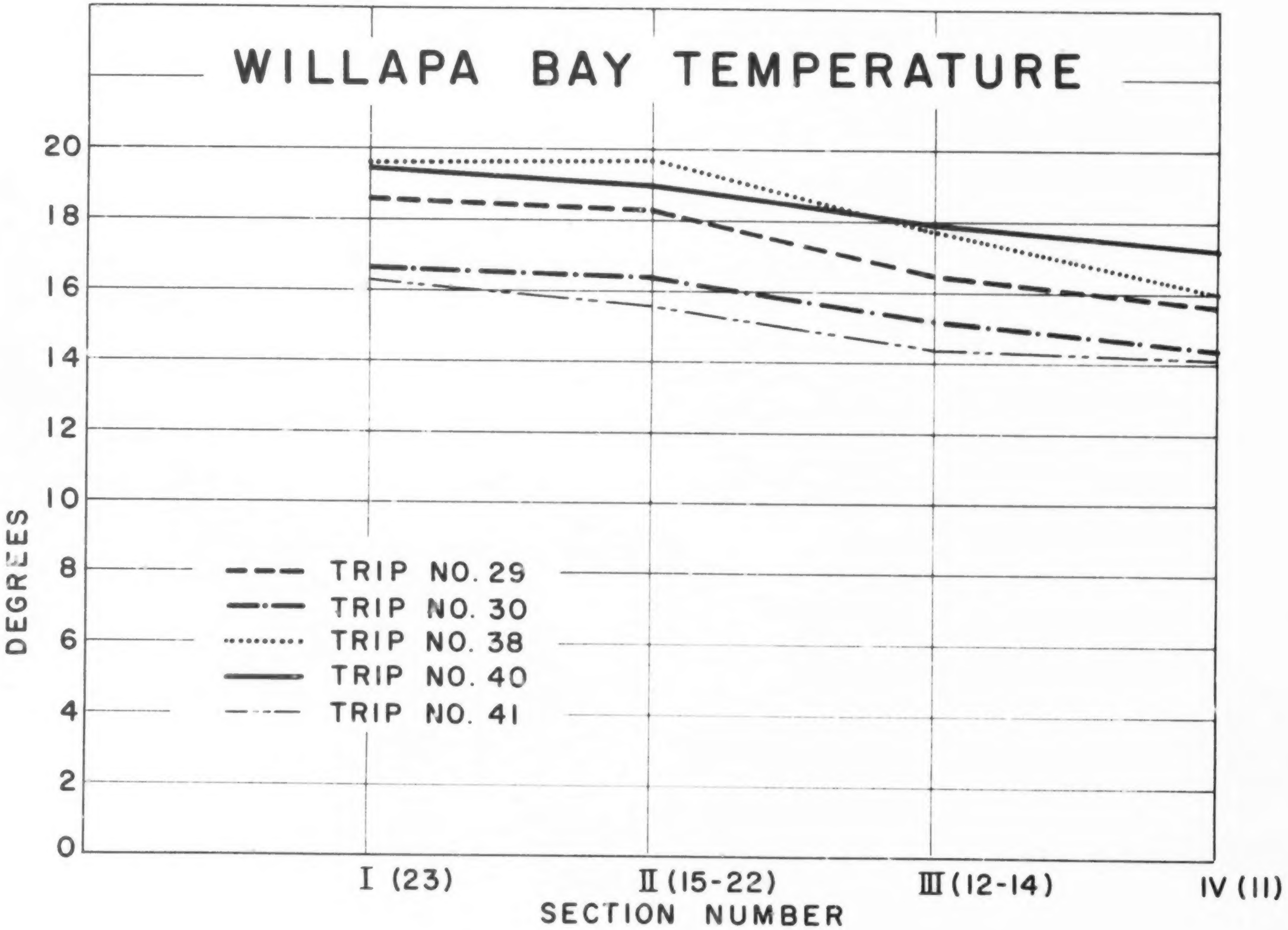

Figure 12. Willapa Bay temperature.

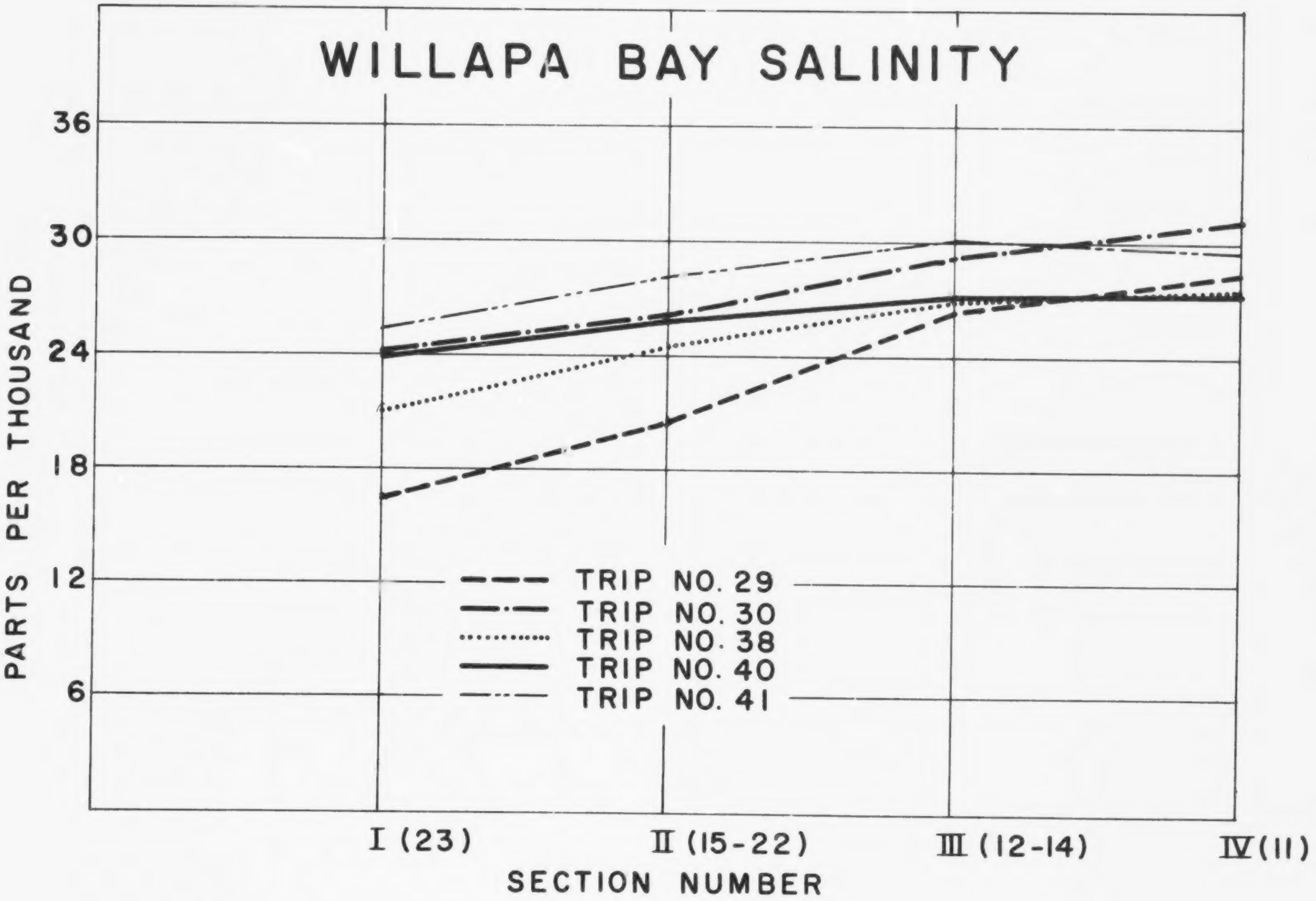

Figure 13. Willapa Bay salinity.

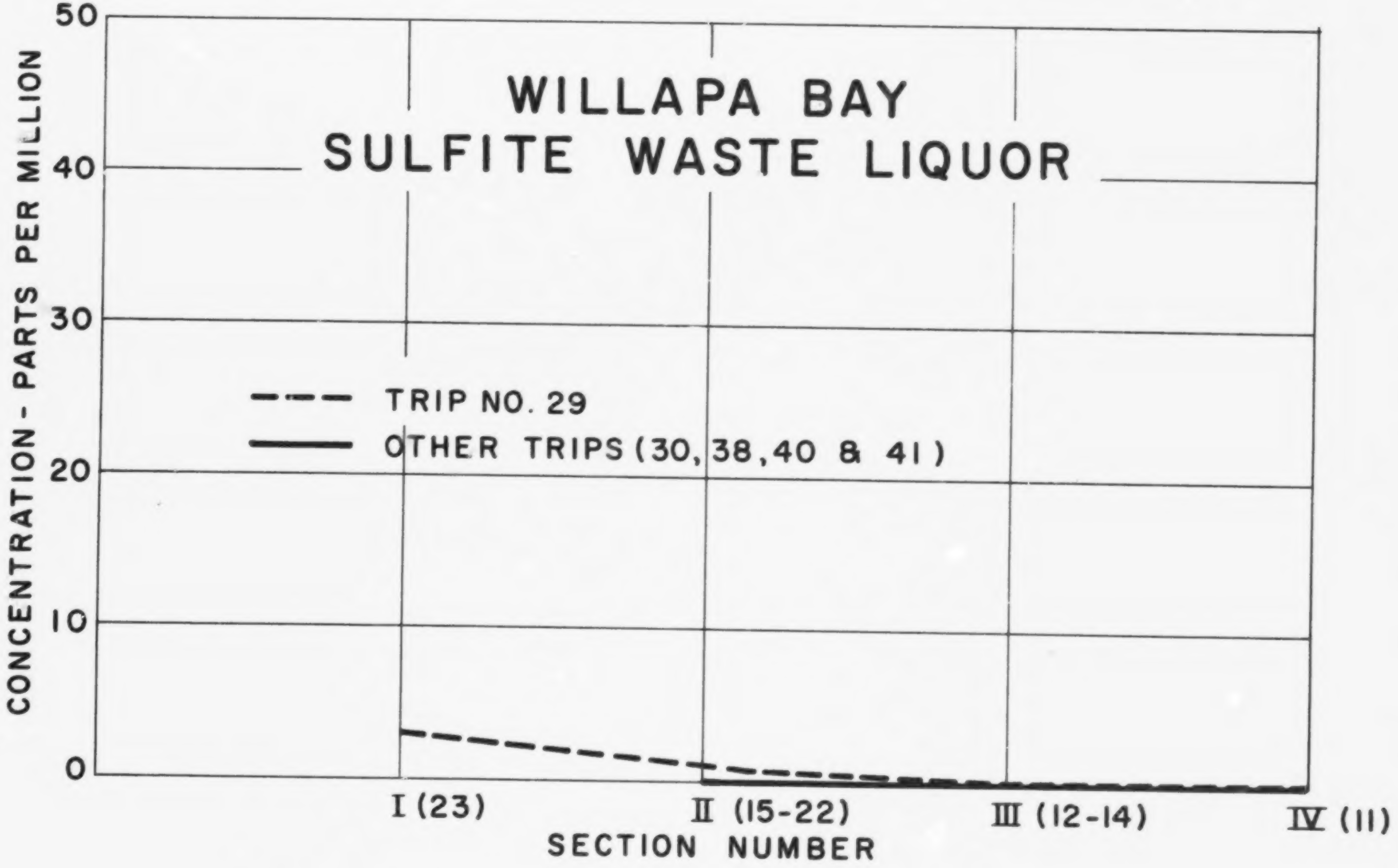

Figure 14. Willapa Bay sulfite waste liquor.

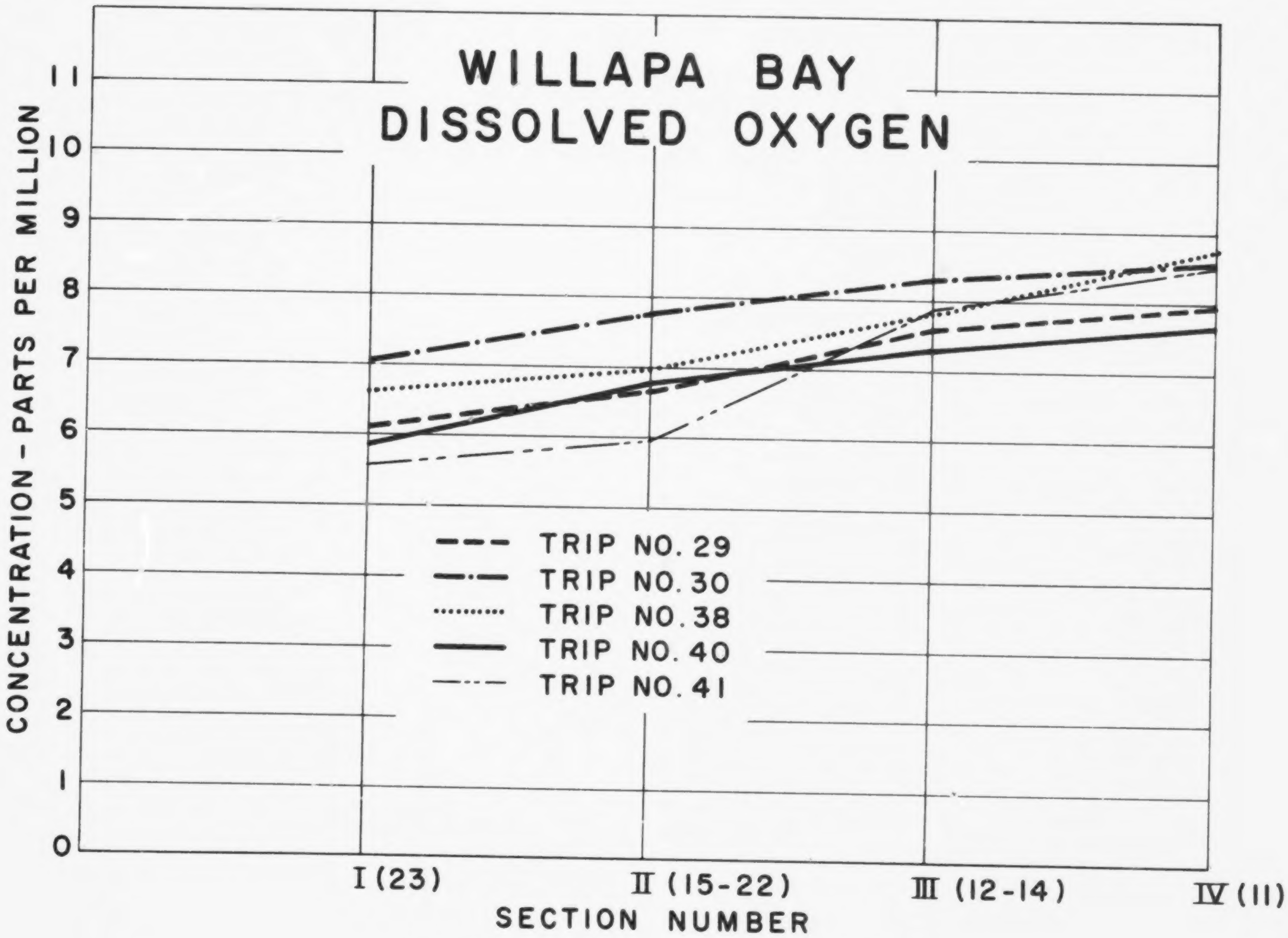

Figure 15. Willapa Bay dissolved oxygen.

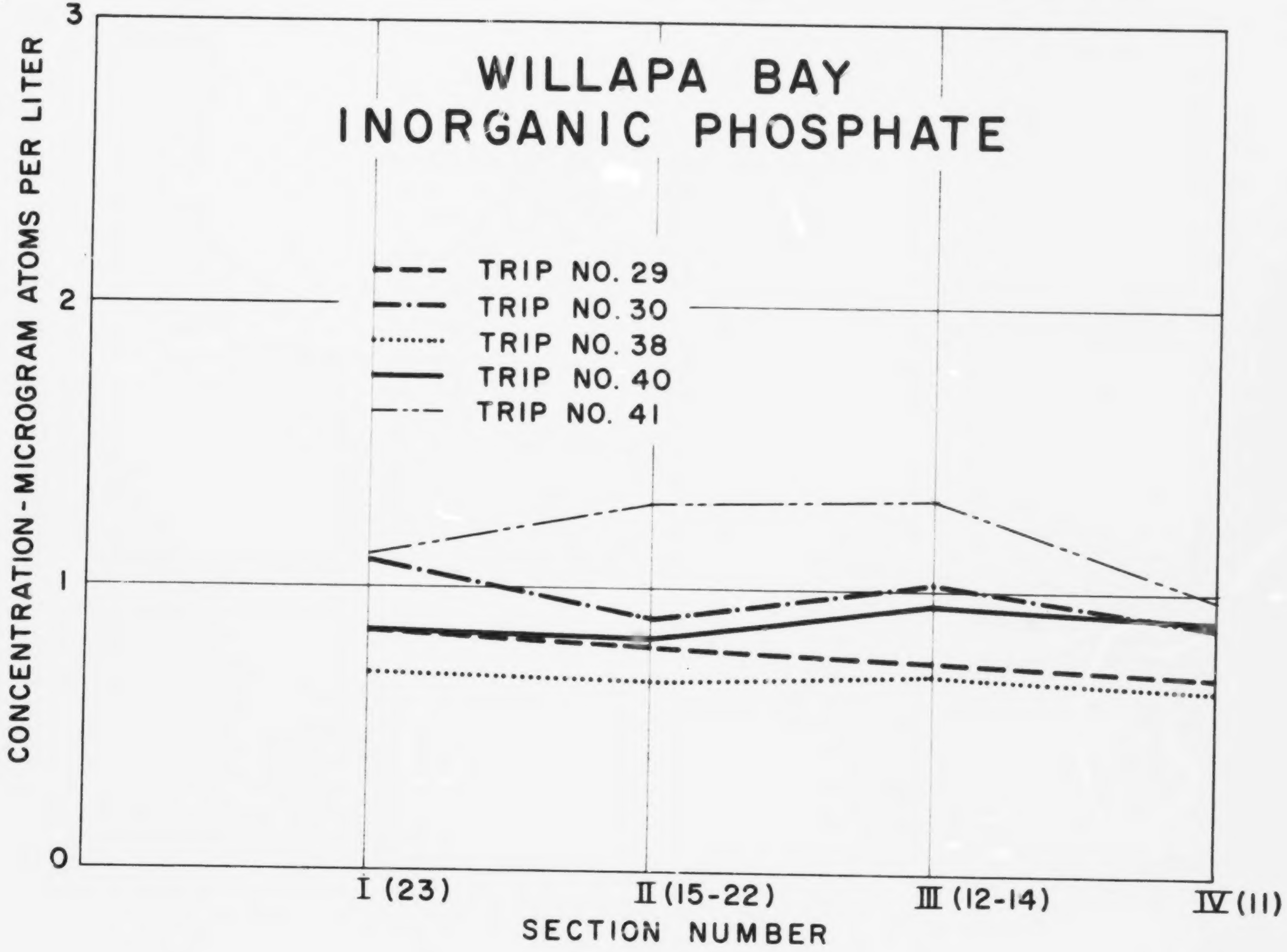

Figure 16. Willapa Bay inorganic phosphate.

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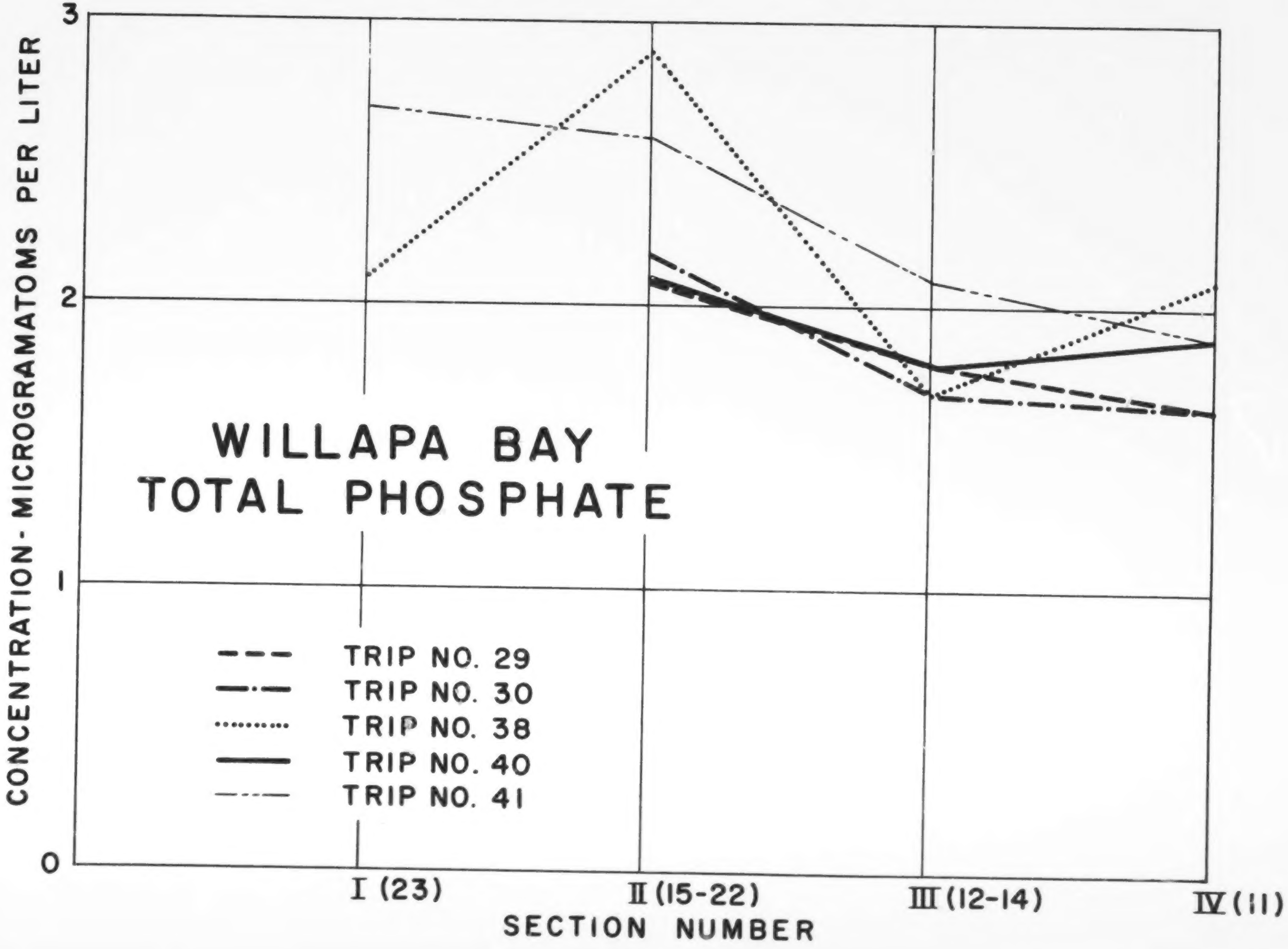


Figure 17. Willapa Bay total phosphate.

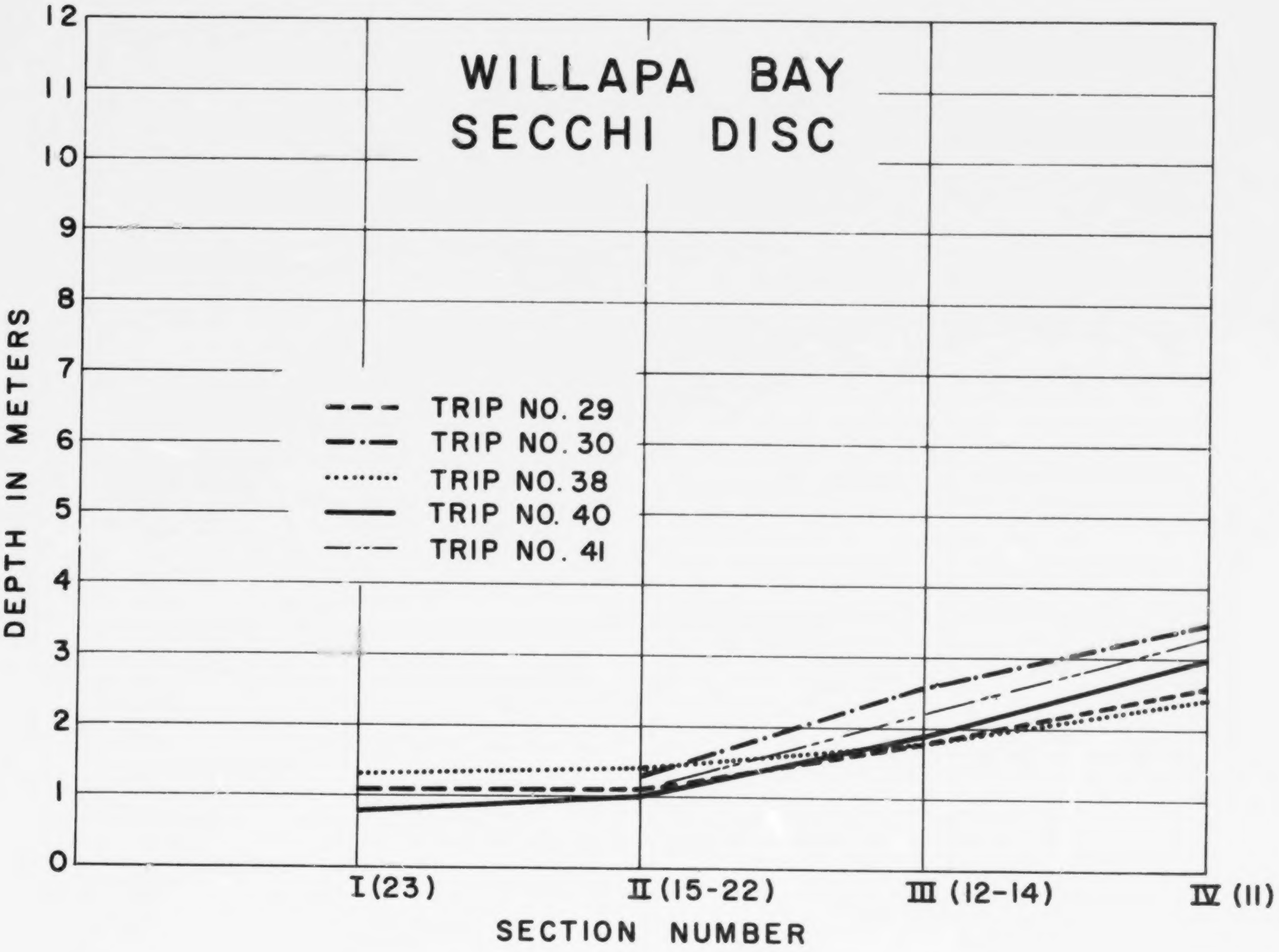
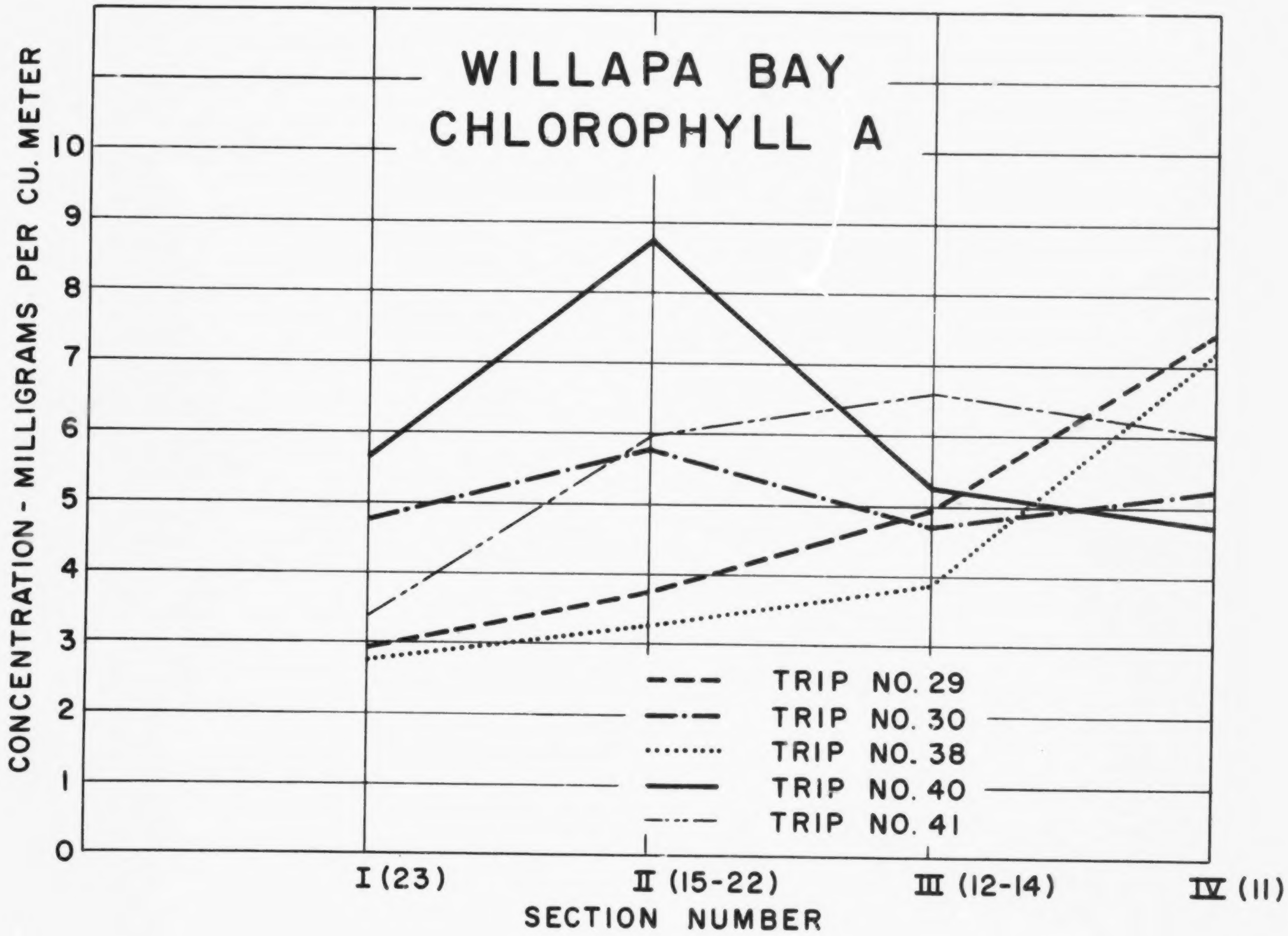


Figure 18. Willapa Bay Secchi disc.


WILLAPA BAY
CHLOROPHYLL A
CONCENTRATION - MILLIGRAMS PER CU. METER
0
1
2
3
4
5
6
7
8
9
10
I (23)
II (15-22)
III (12-14)
IV (11)
SECTION NUMBER
TRIP NO. 29
TRIP NO. 30
TRIP NO. 38
TRIP NO. 40
TRIP NO. 41

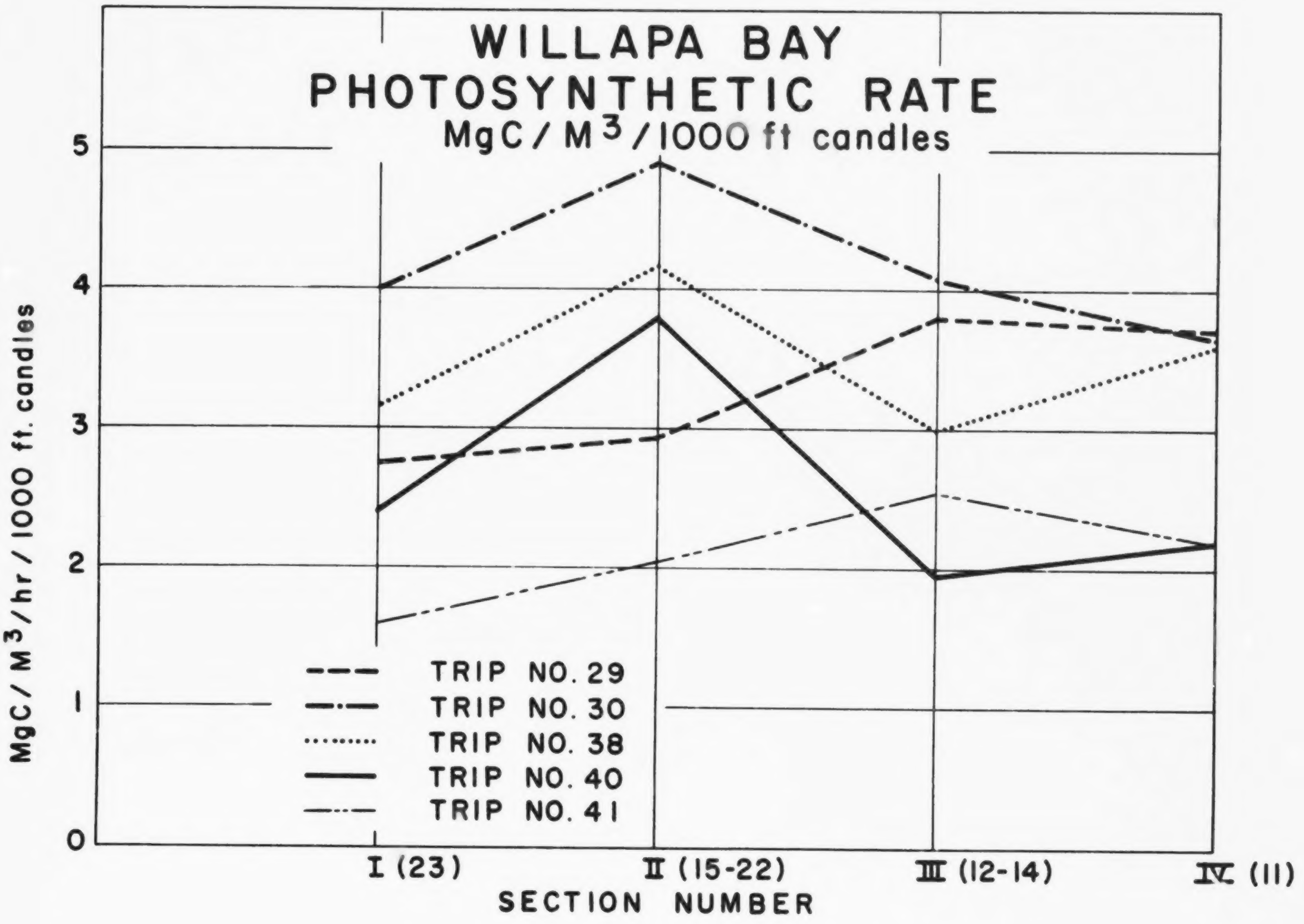


Figure 20. Willapa Bay photosynthetic rate.

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29

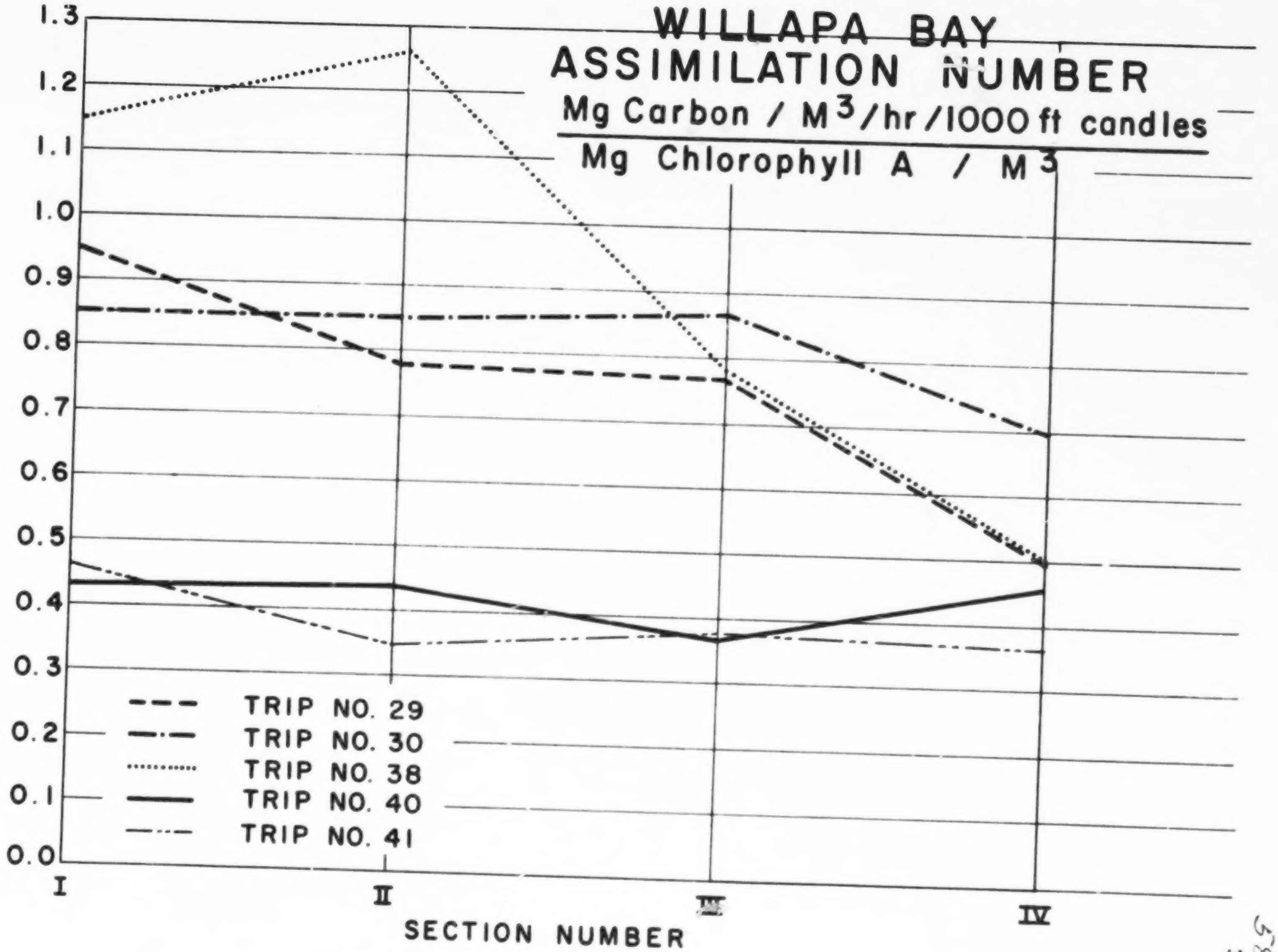

Figure 21. Willapa Bay assimilation number.

585k2

CONGRESS OF AMERICAN FISHERMEN

"Statement of CAF Executive Secretary Dick O'Keef

"October 6, 1967

"My name is Dick O'Keef and I am the Executive Secretary of the Congress of American Fishermen. The Congress of American Fishermen, called CAF, represents the vast majority of West Coast commercial fishermen.

"CAF President William G. Saletic, who could not be here today because of a previous commitment, has instructed me to read into the record the position of CAF in the matter at hand.

"CAF is unalterably opposed to the pollution of our waters. The wanton dumping of wastes into our waters by the pulp mills and other industrial offenders has been going on for years. There is no question of the validity of the findings in the study presented on this subject and the offenders know it. Stringent controls are long overdue.

"It must be obvious to all concerned that the offenders are not going to take corrective action until forced to do so. Therefore, CAF calls for immediate implementation of the Federal recommendations."

- - -

CHAIRMAN STEIN: Thank you.

Will you continue?

LEAGUE OF WOMEN VOTERS, BELLINGHAM, WASHINGTON

MR. POSTON: The letter from the League of Women Voters, Bellingham.

LEAGUE OF WOMEN VOTERS, BELLINGHAM, WASHINGTON

"September 29, 1967

"The League of Women Voters of Bellingham, Washington, is concerned with the effects of existing and potential polluters to the waters in the Puget Sound area, particularly Bellingham Bay and the adjacent Straits of Georgia.

"Our regional planners have as yet done nothing to protect our natural resources from industrial expansion which threatens an important fishing and shell fish industry as well as an unusual diversity of year-round recreational activities.

"The Washington State Pollution Control Commission proposes to assign at this time a "B" classification to Bellingham Bay and a "C" classification to Inner Bellingham Bay hoping to raise water quality to those levels in five years. After that time the commission plans to raise the classification standards for Bellingham Bay from "B" to "A" and for Inner Bellingham Bay from "C" to "B".

"Our studies indicate that setting water quality standards in a series of five-year plans for these two bodies of water would seriously complicate pollution

LEAGUE OF WOMEN VOTERS, BELLINGHAM, WASHINGTON

abatement for the Port and the City of Bellingham. With the lower standards very little additional work is needed at present to meet these standards. Five years from now, however, it will be more costly to proceed to install the required new equipment to meet higher standards. If higher standards have to be met now, all work could be done efficiently with great savings of tax money.

"A thorough, comprehensive watershed plan (including Lake Whatcom, polluted by logging activities, farms, residences and uncontrolled recreation, as a part of the Nooksack River system which eventually flows into Puget Sound) would greatly expedite water management in Whatcom County. Instead we are solving our problems of aesthetics, sanitation and a potable water supply erratically on a piecemeal basis.

"As part of our National Program, the League of Women Voters supports national policies and procedures which promote comprehensive long-range planning for conservation and development of water resources and improvement of water quality. Although the League thinks that costs of pollution abatement are a responsibility of the polluter, it acknowledges that some help should be made available because of the urgency and immediacy of the problem and the immense costs involved.

LEAGUE OF WOMEN VOTERS, BELLINGHAM, WASHINGTON

"We request that this statement become a part of the present Conference on the Matter of Pollution on Interstate Waters of Puget Sound held in Seattle, September 6 and 7, 1967, and on October 6, 1967."

Signed by Mrs. Vernon Tyler and Mrs. Frederick Ellis.

- - -

MR. POSTON: Mr. Chairman, this concludes the matters that we have received during the interim period.

CHAIRMAN STEIN: Thank you.

Without objection, these letters will appear in the record with the dates and the salutations and the conclusions in the form they were received.

I would like to thank all the people who did write in. I think, as you can tell from the record, that they gave careful consideration to their points of view. I think they were admirably expressed I don't know if any positions were changed, but the Conferees and I have had the benefit of these views. We have a very excellent record and the transcript no doubt will be useful for anyone who wants to see clearly expressed the various views on water pollution control.

Now we will move on to the statement by Mr. Harris and Mr. Poston. I believe they have a joint statement.

Mr. Poston?

JOINT STATEMENT OF THE FEDERAL AND STATE CONFEREES

MR. POSTON: Mr. Harris and I felt that some statement concerning the consideration that we have given to the matters presented here should be made before the announcement is made of our conclusions and recommendations.

Mr. Harris has kindly agreed to give a joint statement for the both of us.

CHAIRMAN STEIN: Thank you.

Mr. Harris.

MR. HARRIS: As Mr. Poston indicated, this is a joint statement of the two Conferees to be read for the record.

"During the several weeks that have passed since this Second Session opened on September 6, 1967, we have spent considerable time reviewing the contents of over thirty presentations made at the conference and submitted during the two weeks after it recessed.

"All of the statements centered around the joint Federal-State study in Puget Sound from which the results and recommendations were published in the report, "Pollutional Effects of Pulp and Paper Mill Wastes in Puget Sound," March, 1967. This study was conducted at a cost of over $1.5 million to the Federal Water Pollution

Control Administration and the Washington Water Pollution Control Commission, and utilized the best professionally and scientifically trained people on their respective staffs, other State and Federal agencies, and major Northwest universities. The study and the pro and con arguments thereon provide a comprehensive basis from which to draw firm conclusions and form recommendations.

"Basically, the report stated that certain well defined areas of Puget Sound waters were polluted from pulp and paper mill wastes. This pollution exerted itself at great distances from the mills by being toxic to adult and juvenile oysters, oyster larvae, and flatfish eggs. Nearer the mills, in the confined areas near river mouths, the decomposing sludge beds and large volumes of liquid effluents produced conditions toxic to fingerling salmon and steelhead migrating from the rivers to the ocean. In order to reduce this pollution, the report recommended that all of the pulp and paper mills studied provide primary treatment facilities for wastes containing settleable solids, provide adequate outfall lines, and remove the existing accumulations of sludge beds. The report recommended that four of the mills recover a percentage of sulfite waste liquors from their pulping effluents.

JOINT STATEMENT OF THE FEDERAL AND STATE CONFEREES

"Agreeing with the report conclusions were representatives of the oyster companies, interest groups, and private citizens as well as the following public agencies: the State Department of Fisheries, Game, and Health, the U. S. Public Health Service, Bureau of Commercial Fisheries and Bureau of Outdoor Recreation. Disagreeing with the conclusions were representatives of the pulp and paper mills involved, representatives of the pulp and paper industry, special consultants called by the pulp and paper industry, and certain interest groups.

"Those agreeing with the report pointed out that Puget Sound is a unique and important resource in the State of Washington in terms of food production and recreation, and must be fully protected for these uses. The increasing population of the area and the Nation makes this need for protection even more important. Doubt was expressed by some that the recommendations of the report were strong enough to adequately protect use of these waters.

"The objections to the report may be summarized as follows:

"1. That present levels of sulfite waste liquor in outer bays and harbors are not harmful to any legitimate water uses.

"2. That the Pearl Benson Index is not a proper and scientifically valid test at levels of minimum detectability of sulfite waste liquor.

"3. That results of tests using artifically spawned oyster larvae cannot be applied in the natural environment because conditions are different. Also, that oyster larvae do not exist in the areas in question.

"4. That toxicity of sulfite waste liquor decreases with age.

"5. That data do not support the conclusion that the English sole are harmed by sulfite waste liquor.

"6. That no evidence was given that troubles beset naturally migrating fingerling salmon in inter-harbor areas.

"7. And that no improvement in water quality would be observed (as present levels of sulfite waste liquors are not harmful to other uses) if recovery facilities were installed.

"In order to arrive at our own conclusions in this matter, we carefully considered each of these points.

JOINT STATEMENT OF THE FEDERAL AND STATE CONFEREES

"Both the oyster larvae and flatfish egg bioassays demonstrated to our satisfaction that sulfite waste liquor is toxic to these important marine species during their early stages of development. If it is toxic to the two organisms tested, then it may also be toxic to the early-life form of other resident fish, or shellfish such as clams or crabs. Any substance discharged into the environment, such as sulfite waste liquor, causing organic deformities in an organism as complex as the Pacific oyster, must be controlled. We cannot wait for pollution to cause mass mortalities in the marine environment. When recognized chemical and biological tests indicate that water pollution is present, and that toxic conditions exist to the degree demonstrated in this study, these conditions must be corrected. Therefore, we believe present toxic levels of sulfite waste liquor in outer bays and harbors are harmful to other water uses.

"The presentation discussing the results of the water quality studies answers to our satisfaction the question regarding the validity of the Pearl Benson Index test results. Pearl Benson Index readings taken from the waters under question demonstrated PBI at or near zero during mill closures and far above 10 ppm during mill operation. There were no "background" substances to cause the PBI reaction in these waters. It is clear to us that the PBI test in these study areas was, in fact, measuring sulfite waste liquor.

"To answer the question regarding the use of artificially spawned oyster larvae, we have gone to some supplemental material submitted for the record by the Washington State Department of Fisheries during the two weeks following the conference. We have learned that the conditions under which these tests were run are most favorable to the proper development of oyster larvae. This conclusion is well substantiated by the high rate of survival in the control portion of these tests.

"To resolve the question of the toxicity of sulfite waste liquor decreasing with age, we again went to the presentation describing the oyster larvae studies. For the most part, the oyster larvae bioassays were conducted with individual water samples collected from each station by float plane. In other words, the sulfite waste liquor for which toxicity levels were established had gone through the natural aging process in the receiving water. Therefore, even if the toxicity of the waste liquor does decrease with age, this decrease was accounted for in the tests and in the report recommendations.

JOINT STATEMENT OF THE FEDERAL AND STATE CONFEREES

"The studies regarding the English sole dealt mostly with the toxicity that sulfite waste liquor exhibited toward the development of the eggs. The material presented in opposition to these findings included quotations from commercial fishermen who fish for sole in the Everett area, and a bioassay study using 24 flatfish eggs which had been collected from Port Gardner. We conclude that, since English sole are known to migrate for many miles during their growth stages, the presence of commercial quantities of adult sole in an area is not necessarily indication of good egg survival in that area. The report's bioassay data showed that a reduction of sulfite waste liquor in these areas would increase the number of English sole eggs developing properly. We cannot consider biological information obtained by using only 24 flatfish eggs from Port Gardner to be sufficient to refute the report's findings.

"As in the discussion on the differences of opinion on the English sole egg studies, the data presented to refute the study's conclusions that naturally migrating fingerling salmon were endangered in the inter-harbor areas cannot be correlated with the data used to arrive at those conclusions. Fish (fingerling salmon) were held in boxes in areas known to be used as migration routes. On many occasions these fish were killed by toxic conditions. On a few occasions the fish were not killed. These studies demonstrated that conditions toxic to fingerling salmon do exist in the inter-harbor areas, and fingerling salmon do use these areas for migration. The fact that a good adult population of salmon and steelhead return annually to the streams in these areas is a credit to the State Departments of Fisheries and Game who provide so many hatchery-reared fish to migrate through these areas. We believe that improved water quality in these areas will increase the number of downstream migrants that survive the trip to the ocean.

"Finally, it has been demonstrated to our satisfaction that, if the recommendations are followed, enhancement of water uses will be achieved in the waters being considered.

"There is no question now, from the water quality standpoint, that pollution exists and abatement is needed. We believe the recommendations of this conference are reasonable and feasible from both the technical and economic standpoint. No more is being asked of the Puget Sound mills than has been asked of similar mills located on the Columbia and Willamette Rivers in Washington and Oregon and other regions of the Nation. The fact that these mills are now in the process of building primary treatment and recovery facilities points out that our goals of having both pulp and paper mills and clean water can be achieved.

"We grant that the cost of carrying out the conference recommendations may be large. We believe these costs can be absorbed by the pulp and paper industry and the users of their products. The contribution of sulfite pulp and paper production to the Northwest's economy will not be lessened by our recommendations, and because of the nationwide adoption and enforcement of water quality standards, these recommendations will not endanger this industry's competitive position. We cannot afford the cost in terms of degradation of the environment in not exercising adequate water pollution control.

"The only remaining question is whether or not the conference recommendations for abatement will be followed. Actually, there should be no question here either. The desire to have clean water, as clean as practically and technically possible, has been expressed by lawmakers at all levels of government in our Nation. The issues and controversy have been debated in the legislative chambers. Both the laws of the State of Washington

JOINT STATEMENT OF THE FEDERAL AND STATE CONFEREES and the Federal Water Pollution Control Administration require that all known, available and reasonable methods be employed to enhance and maintain water quality at a high level. With this directive, we can do no less than make the recommendations established here today."

- - -

CHAIRMAN STEIN: Thank you.

MR. HARRIS: Thank you, Mr. Chairman.

CHAIRMAN STEIN: Thank you, Mr. Harris and Mr. Poston, for that statement.

We now have the summary of the Conference and conclusions and recommendations. But before I go into that, I would like to announce that in the work done by the State of Washington and the Federal people an economic report and study was included. The material, I understand, on this report is being gathered together and will be available by November 1st at the Federal Water Pollution Control Administration's offices in Portland for full inspection by any interested party.

SUMMARY OF CONFERENCE

CHAIRMAN STEIN: The summary of the Conference follows, and I would like the entire summary to appear in the record as if read. I will skip the preliminary material dealing with jurisdiction and the attendance of the Conference in order to save time. There are copies of this which will be available at the conclusion for those who may want to look at this preliminary material, but it is largely what we call in the trade "boiler plate" language and will contain no surprises.

SUMMARY OF CONFERENCE

Second Session

POLLUTION OF INTERSTATE WATERS OF PUGET SOUND, STRAIT OF JUAN DE FUCA, THEIR TRIBUTARIES AND ESTUARIES

Seattle, Washington
September 6-7 and October 6, 1967

"The Second Session of the conference in the matter of pollution of the interstate waters of Puget Sound, the Strait of Juan de Fuca, their tributaries and estuaries, was held on September 6-7, 1967, at Seattle, Washington, under the provisions of Section 10 of the Federal Water Pollution Control Act, as amended (33 U. S. C. 466 *et seq*.). The First Session of the conference was held on January 16-17, 1962, in Olympia, Washington, at the request of the Governor of the State of Washington.

"The conferees at the First Session agreed that Puget Sound and adjacent waters were polluted as a result of discharge of pulp and paper mill wastes, and that such pollution was subject to abatement under the Federal Water Pollution Control Act. The recommendations of the conferees at the First Session called for a joint Federal-State program to study the extent of pollution and its effects and to define the abatement requirements necessary to protect the water uses, particularly the fisheries, in and around Puget Sound.

"The Second Session of the conference was called specifically to review the findings of the joint Federal-State program, as published in the report entitled, "Pollutional Effects of Pulp and Paper Mill Wastes in Puget Sound." The report was published in March 1967, and received wide distribution in the Puget Sound area. The conferees heard statements regarding the study, its findings and recommendations, from representatives of Federal, State, and local governmental agencies, the fishery industry, the pulp and paper industry, and universities.

"The following conferees represented the Washington Water Pollution Control Commission and the Federal Water Pollution Control Administration at the Second Session of the conference:

"Roy M. Harris Director	Washington Water Pollution Control Commission, Olympia, Washington
"Richard F. Poston Regional Director Northwest Region	Federal Water Pollution Control Administration, Portland, Oregon

SUMMARY OF CONFERENCE

"Murray Stein Assistant Commissioner for Enforcement	Federal Water Pollution Control Administration, Washington, D. C.

"The following individuals and agency representatives participated in the conference:

"Marvin O. Allum Water Quality Standards Coordinator	Federal Water Pollution Control Administration, Northwest Region, Portland, Oregon
"Herman Amberg Manager, Manufacturing Services	Crown Zellerbach Corporation, Camas, Washington
"R. H. Bailey Managing Director	Citizens for Clean Waters Seattle, Washington
"William J. Beck Chief	Shellfish Sanitation Laboratory Public Health Service, Gig Harbor, Wash.
"Donald J. Benson Executive Secretary	Northwest Pulp & Paper Association Seattle, Washington
"Bob O. Bower President	Pacific Coast Oyster Growers Assn. Olympia, Washington
"E. J. Cavanaugh Plant Manager	Fibreboard Paper Products Corporation Port Angeles, Washington
"William J. Dittrich	Lake Whatcom Improvement Committee Bellingham, Washington
"John Douglas Fisheries Biologist	Washington Game Department Olympia, Washington
"J. H. Dunkak General Manager Puget Sound Division	Georgia-Pacific Corporation Bellingham, Washington
"Thomas Saunders English	Everett Mills Technical Council Everett, Washington
"B. J. Gilshannon Chairman Executive Committee	Lake Whatcom Improvement Committee Bellingham, Washington

"John B. Glude Deputy Regional Director	Pacific Northwest Region U. S. Bureau of Commercial Fisheries Seattle, Washington
"Edward J. Gruble President	Oyster Institute of North America Seattle, Washington
"Eugene P. Haydu Biologist, Pulp Research Department	Weyerhaeuser Company Longview, Washington
"J. O. Julson Director, Air Water Resources	Weyerhaeuser Company Tacoma, Washington
"Earl N. Kari, Acting Director, Technical Programs	Federal Water Pollution Control Administration, Northwest Region, Portland, Oregon
"Max Katz, Research Associate Professor	Department of Fisheries, University of Washington, Seattle, Washington
"J. E. Lasater Assistant Director of Research	Washington Department of Fisheries Olympia, Washington
"Norman J. MacDonald Chief, Water Control	Corps of Engineers, Seattle District, Seattle, Washington
"Joseph L. McCarthy Professor Pulp Mills Research	University of Washington, Seattle, Washington
"A. Murl Miller Senior Process Engineer	Scott Paper Company Everett, Washington

SUMMARY OF CONFERENCE

"Fred J. Overly Regional Director	Pacific Northwest Region Bureau of Outdoor Recreation Seattle, Washington
"Phil Parker Executive Secretary	Pacific Coast Oyster Growers Association, Olympia, Washington
"James E. Phillips President	Port Angeles Chamber of Commerce Port Angeles, Washington
"James C. Plunter Head, Sanitary Engineering Section	Washington State Department of Health, Olympia, Washington
"Ernest O. Salo Associate Professor	Fisheries Research Institute University of Washington Seattle, Washington
"R. N. Steele Owner	Rock Point Oyster Co. Blanchard, Washington
"Robert O. Sylvester Professor of Sanitary Engineering	University of Washington Seattle, Washington
"Robert I. Thieme General Manager	West Coast Division Scott Paper Company Everett, Washington
"Roger Tollefson Research Supervisor Olympic Research Division	Rayonier Incorporated Shelton, Washington
"John J. Vlastelicia Acting Chief Technical Operations Branch	Federal Water Pollution Control Administration, Northwest Region, Portland, Oregon

SUMMARY OF CONFERENCE

"Charles S. Yentsch	Woods Hole Oceanographic
Institution, Woods Hole,
Massachusetts

"The waters considered by the conferees were Puget Sound, the Strait of Juan de Fuca, their tributaries and estuaries. The geographical region generally known as Puget Sound supports a population of approximately two million, supported by a diverse economy centering upon the aircraft industry, oil refining, pulp and paper manufacturing, and service industries. The waters of Puget Sound and adjacent area serve a variety of uses contributory to the area's economy, including a valuable commercial and sport fishery, water transportation--both commercial and recreational--varied recreational opportunities, tourism, and a valuable aesthetic environment for homes and services.

"The specific areas investigated for purposes of complying with the First Session of the conference were the Bellingham, Anacortes, Everett, and Port Angeles areas of Puget Sound. Eight pulp and paper mills and three municipalities were shown to be discharging untreated wastes into these waters:

"Georgia Pacific Corporation, Bellingham, Washington;

"Scott Paper Company, Anacortes, Washington;

"Scott Paper Company, Everett, Washington;

"Weyerhaeuser Company, Everett, Washington;

"Simpson Lee Paper Company, Everett, Washington;

"Fibreboard Paper Products Corporation, Port Angeles, Washington;

"Crown Zellerbach Corporation, Port Angeles, Washington;

"Rayonier Incorporated, Port Angeles, Washington;

"City of Bellingham, Washington;

"City of Everett, Washington; and

"City of Port Angeles, Washington.

"At the conclusion of the Second Session of the conference, the Chairman granted a request to hold the conference record open for two weeks to allow submittal of additional materials. The Chairman also directed a team to be named by the Washington Water Pollution Control Commission and the Federal Water Pollution Control

Administration, Northwest Region, to visit the pulp mills to review the waste treatment and control recommendations of the joint study. Based upon information received during the conference and during the succeeding two weeks, the conferees reached the following conclusions:

"1. Sulfite waste liquor discharged into the waters of Puget Sound from the four largest sulfite mills (Georgia Pacific Corporation at Bellingham, Scott Paper Company and Weyerhaeuser Company at Everett, and Rayonier Inc. at Port Angeles) produce concentrations of sulfite waste liquor well in excess of ten parts per million throughout large areas of Puget Sound in the vicinity of Bellingham, Everett and Port Angeles.

"Bioassay studies conducted by the joint Federal-State project showed that sulfite waste liquor concentrations in excess of ten parts per million were damaging to oyster larvae and English sole eggs, and, in some cases, caused adult and juvenile oyster mortality. To reduce these damages and provide minimum protection of fish and shellfish during their most sensitive period of development, the report recommended that sulfite waste liquor concentrations not exceed ten parts per million in the surface fifty feet of water depth outside an initial dispersal zone.

"Nearer the mills, within the inner harbor areas, sulfite waste liquor concentrations often exceed 1000 parts per million and, when combined with other wastes from the mills, produce conditions toxic to more mature life forms, and cause severe dissolved oxygen depression.

"2. Waste waters containing large volumes of settleable solids that are discharged into the water near the mills have caused extensive bottom sludge deposits in these areas. Toxic components in these effluents, and the toxic sulfides produced by the decomposition of these sludge deposits, have been demonstrated to produce conditions toxic to juvenile salmon migrating through these areas.

"3. Bacterial studies demonstrated that the waters of Bellingham Bay, Everett Harbor, and Port Angeles Harbor are bacterially contaminated for water contact use because of inadequately treated sewage discharges from the city of Bellingham, Everett and Port Angeles.

"4. The contributions of other less significant waste discharges into the study areas were considered in the March 1967 report. Since significant changes have occurred with these discharges since the report was published, and their contribution is very small when compared to the discharges from the pulp and paper mill, specific recommendations of the conference are not required at this time.

"Based upon the preceding conclusions, the conferees unanimously adopted the following recommendations:

"1. Georgia Pacific Corporation at Bellingham shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Design and construct facilities which will either remove a minimum of 80 percent of the sulfite waste liquor from mill effluents or limit sulfite waste liquor discharges to 3,600,000 pounds per day, based on 10 percent solids by weight. These facilities are to be completed and placed into operation no later than September 30, 1972.

"c. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"d. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"e. Modify chipbarge unloading operations to eliminate spillage of wood chips. This shall be completed no later than September 30, 1970.

"2. Scott Paper Company at Anacortes shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"3. Scott Paper Company at Everett shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Design and construct facilities which will either remove a mimimum of 80 percent of the sulfite waste liquor from mill effluents or limit sulfite waste liquor discharges to 5,500,000 pounds per day, based on 10 percent solids by weight. These facilities are to be completed and placed into operation no later than September 30, 1972.

"c. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"d. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"e. Modify chipbarge unloading operations to eliminate spillage of wood chips. This shall be completed no later than September 30, 1970.

4. Weyerhaeuser Company sulfite mill at Everett shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Design and construct facilities to either remove a minimum of 80 percent of the sulfite waste liquor from mill effluents or limit sulfite waste liquor discharges to 2,200,000 pounds per day, based on 10 percent solids by weight. These facilities are to be completed and placed into operation no later than September 30, 1972.

"c. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"d. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"e. Modify chipbarge unloading operations to eliminate spillage of wood chips. This shall be completed no later than September 30, 1970.

"5. Simpson Lee Paper Company at Everett shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Provide an outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the waters of the Snohomish to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"6. Crown Zellerbach Corporation at Port Angeles shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. The date that these facilities shall be placed in operation is contingent upon a reasonable length of time for the company to stabilize mill property now being eroded away through wave action.

"b. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation concurrently with the primary treatment facilities.

"c. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"7. Fibreboard Paper Products Corporation at Port Angeles shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"c. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"8. Rayonier Incorporated at Port Angeles shall:

"a. Design and construct primary treatment facilities to remove all settleable solids from mill effluents prior to discharge into Puget Sound. Adequate facilities for the disposal of recovered solids or sludge shall also be provided. These facilities shall be placed in operation no later than September 30, 1970.

"b. Design and construct facilities to either remove a minimum of 80 percent of the sulfite waste liquor from mill effluents or limit sulfite waste liquor discharges to 3,700,000 pounds per day, based on 10 percent solids by weight. These facilities are to be completed and placed into operation no later than September 30, 1972.

"c. Provide a submarine outfall equipped with an adequate diffuser to permit discharge of all residual wastes into the deeper waters adjacent to the mill to achieve maximum waste dilution and dispersion. The outfall is to be designed and located by an extensive outfall evaluation of the receiving watercourse and is to be completed and placed in operation no later than September 30, 1970.

"d. Remove, by dredging, the existing sludge bed in the waterways adjacent to the mill and dispose of the sludge on land when feasible. The schedule for this operation will be dependent upon integrating it with the construction of primary treatment and outfall facilities.

"9. The City of Bellingham shall:

"a. Provide for collection and treatment of wastes discharged by the Fairhaven sewer and other unintercepted waste discharges no later than March 31, 1970.

"b. Construct a submarine outfall from the present primary plant into the deep water of Bellingham Bay to achieve maximum waste dilution and dispersion no later than March 31, 1970.

"c. Conduct an engineering study to determine whether a higher degree of treatment than primary treatment will be necessary to comply with receiving water standards and submit an engineering report no later than December 31, 1969.

"10. The City of Everett shall:

"a. Provide chlorination of the waste stabilization pond effluent no later than July 31, 1968.

"11. The City of Port Angeles shall:

"a. Provide for collection of all domestic waste discharges and treatment of the wastes by providing primary treatment and effluent chlorination with discharge into a deepwater outfall no later than March 31, 1969."

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CHAIRMAN STEIN: This concludes the findings, conclusions and recommendations of the Conferees. I would like to remind all concerned that Mr. Harris' door, Mr. Poston's door and mine are open at all times for individual consultation by any of the people named, any corporations named in this report, any municipalities, or any interested parties, with a view toward clarification or discussion of a plan for meeting these requirements. I think we are at the end of a long road here and I hope at the beginning of another one, the road toward clean waters.

We have copies of the statement and the summary which will be made available so long as the supply holds out. If you are not able to get one today, they will be made available to you through Mr. Harris and Mr. Poston.

We would like to thank all for coming. This Conference stands adjourned.

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(Whereupon, the Conference adjourned at 10:30 a.m.)